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MIDDLE EAST GEOGRAPHY IN RELATION TO PETROLEUM: *A paper read at the Evening Meeting of the Society on 11 June 1934, by*

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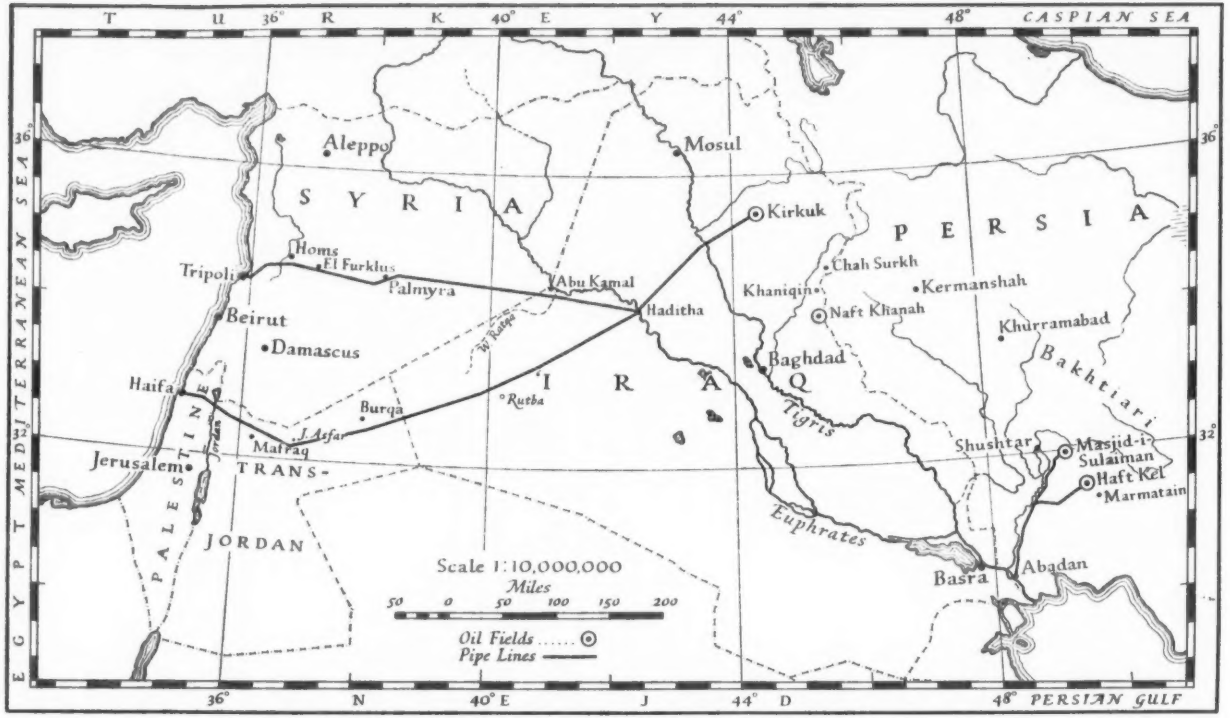
THE oilfields of the Middle East, so far as they are yet known, are situated in south-western and western Persia, and in the eastern regions of 'Iraq. In Persia, oil is derived mainly from two fields—at Masjid-i-Sulaiman, 29 miles south of east from Shushtar, and Haft Kel, 38 miles farther to the south-south-east. In 'Iraq the principal producing field is in the neighbourhood of Kirkuk, to the east of the river Tigris and 145 miles north of Baghdad. A further oilfield of less importance than the three which I have just mentioned lies across the Perso–'Iraqi frontier at Naft Khanah, to the south of Khaniqin.

The exploitation of petroleum on a modern commercial scale in Persia and 'Iraq is a very recent development. Knowledge of the existence of oil, as well as knowledge of some of its uses, is however of great antiquity. Bituminous mortar was in use in the country which is now 'Iraq as long ago as 4000 B.C.; and pitch, as you are aware, is frequently mentioned in the Old Testament. Herodotus, also, refers to its use in the structures of Babylon. Sir Thomas Herbert, describing his visit in 1628 to the province of Lar, remarks that "the diameter of this province is about . . . 300 miles English; said, by old authors, to be full of springs, grass, and fruit; but length of time has, it seems, much altered it, for in crossing the country we found the greatest part barren. . . . Yet though the ground be bad, nevertheless 'tis thought here are mines of sundry sorts and sulphur, which makes some amends, but for want of art remain hid and undiscovered." Captain Alexander Hamilton, in a breezy account of his voyages up and down the Persian Gulf in the early years of the eighteenth century, wrote of Lar: "Four days' journey within land (*i.e.* from the coast of the Persian Gulf) is the city of Laar, which, according to their fabulous Tradition, is the burying place of Lot, and they pretend to show his tomb still; but they do not know a word about the poor woman his wife. That there are many mountains of rock salt there is very certain."

The known petroliferous regions of Persia and 'Iraq are much alike in their surface structure and in the nature and habits of the human beings who formed


T U R K E Y
36°
40° E
44°
48°
CASPIAN SEA
PERSIA
SYRIA
IRAQ
Aleppo
Mosul
Kirkuk
Homs
El Furklus
Tripoli
Palmyra
Abu Kamal
Haditha
Chah Surkh
Khaniqin
Kermanshah
Naft Khanah
Khurramabad
Beirut
Damascus
Baghdad
Bakhtiari
Haifa
Burqa
Rutba
Tigris
Shushtar
Masjid-i-Sulaiman
Haft Kel
Marmatain
Jerusalem
Mafraq
Jordan
TRANS-JORDAN
PALESTINE
Euphrates
Basra
Abadan
Scale 1:10,000,000
Miles
50 0 50 100 150 200
Oil Fields .....
Pipe Lines
EGYPT
MEDITERRANEAN SEA
PERSIAN GULF
32°
36°

their sparse populations in times when oil was regarded chiefly as a natural phenomenon and not yet as a mainspring of industrial operations. Sir Henry Layard, in 1840, travelled through the country inhabited by the Bakhtiari—"a nomad mountain tribe renowned for its courage and daring and dreaded by the settled inhabitants of the plain." This part of Persia, he says, "had always been in a very disturbed state and its population appeared to live in perpetual warfare. Life and property were nowhere safe, and the villages were for the most part in ruins." W. K. Loftus, who visited Persia in 1855, mentions the bitumen springs, which he examined in the Bakhtiari mountains. He remarks that the springs are situated "in a wild and barren region of much-contorted and highly elevated ridges of sandstone, marls and gypsum." In these regions there were no cities or towns; virtually no villages, and no roads. Nomadic tribes formed the only population, and the suzerainty of former Shahs barely extended into the tribal fastnesses. It was in regions such as this, and among such people, that the oil industry of Persia was founded.

In the days when Loftus visited Persia—and for many centuries before—a primitive industry concerned with bitumen was in existence. At a certain point in the Bakhtiari mountains—"between the curious and ancient temple of Masjid-i-Sulaiman and the mountain of Asmari"—a small stream of cold water descended a ravine and was increased by streamlets from many sources carrying with them liquid black bitumen and white naphtha mixed together. The oily substances floated on the surface of the stream and were conveyed to an artificial dam. From this the water was drawn off and the bituminous mixture was left exposed to the heat of the sun until it attained the consistency of soft mud. The bitumen was slightly heated and allowed to cool, when it was ready for use as a substitute for mortar and for various other purposes, including the cure of mange on camels. Fifty-three years later the scene of this primitive exploitation was to witness the birth of a great industry, but in 1855 the possibility of extracting oil from the earth by means of a mechanically drilled well had not yet been conceived.

Several years passed before any commercial attention was attracted to the possibilities of oil in Persia. The nineteenth century witnessed no more than abortive attempts; and it was not until the early months of 1900 that the history of the development of Persian oil really began. It reached a decisive, if early, stage in May 1901, when the Persian Government granted an oil concession to Mr. William Knox D'Arcy, the forbear of the Anglo-Persian Oil Company.

The grant of a concession, although it is decisive, is no more than a preliminary stage. The progress from securing the concession to the discovery of oil in Persia was not achieved without failure, discouragement, or vicissitude in almost every phase. Very large sums were expended with mainly negative results. The search was prosecuted for several years. In the first place wells were drilled at Chah Surkh, a spot equidistant from Baghdad and Kermanshah. Some three years later, drilling was also begun at Marmatain in the southern Bakhtiari country. It was not however until 1908 that the cap-rock covering the great reservoir at Masjid-i-Sulaiman—then known as Maidan-i-Naftun, the Valley of Oil—was first pierced by the drill. The discovery of oil in great quantities was, of course, an epoch-making stage in Persian petroleum operations. It marked the climax of one series of activities, and although it closed

a chapter of great human achievement, it marked also the commencement of others. In them many formidable obstacles were to be surmounted.

The country in which petroleum operations were to be conducted was, as I have said, wild, rugged, and mountainous. It had to be made accessible; opened for the transport of the apparatus—frequently very heavy—of petroleum operations; and rendered safe and habitable, not for nomads but for men accustomed to the civilization of distant parts of the earth. The undertaking, as it may be imagined, was of formidable magnitude. Heavy machinery and cumbersome apparatus—to say nothing of the swift conduct of industrial affairs—need good roads, not the tracks which are adequate to nomads and their four-footed transport. In all, 1600 miles of roadway, many of them skirting precipitous hillsides, have been constructed by the Anglo-Persian Oil Company within the area of its operations in Persia.

At one stage or another in the exploitation of Persian oil, light railways, telephone and telegraph lines, pumping stations and pipes for water supply, all became essential. Housing had to be provided for a force which grew from a handful to many thousands. The whole business of supply in a barren land had to be inaugurated, developed, and expanded proportionately with the growing momentum of the operations which it tended. And, finally and most importantly, the oil-producing operations themselves had to be pursued with a relentless vigour day by day and year upon year.

The most continuous of these operations was the drilling of wells. In the early days drilling took the form of literally punching a hole downwards by the impact of a heavy steel bit, raised and allowed to fall sharply by steam-operated drilling equipment. (337 wells of an aggregate depth of 775,000 feet have been drilled by this and other methods.) Each well, as it pierced the cap-rock, entered a zone of high-pressure oil or gas; and fittings throughout had to be of a strength and weight more than adequate to cope with any potential strain. Boilers weighing 14 or 15 tons, pipes, casings for wells, steel for derricks, endless quantities of cable—all had to be transported, erected, and put to work.

When oil was obtained and before effective production could begin, many other facilities had to be provided. Tanks were needed for storage at the fields; 150 miles of pipe-line had to be laid between Masjid-i-Sulaiman and Abadan, on the Persian Gulf. A refinery had to be built—on an island of sand and mud. These activities, mentioned so briefly, were great enterprises in themselves. And each was part of a still greater undertaking. It is hard to describe—and still harder to visualize—the dimensions and difficulties of such a task. Almost every obstacle of nature and climate opposed its achievement; and the pioneers who led the way in those early years around and since 1908 were called upon to display almost superhuman energy and resource in their work of planting a modern industry in those rude and inhospitable regions. That they succeeded is a tribute to their high qualities.

So much for the scene of operations and for the work that had to be done. There remains a further factor to be mentioned—the "labour force" without which an industrial enterprise can neither be founded nor continued. The labour force available to our pioneers in the Bakhtiari mountains consisted almost solely of those nomadic tribesmen whom I have already mentioned. Their ways of life, as you may imagine, fitted them for little else than the con-

ditions in which they then existed. They served, nevertheless, to provide the man-power required for the "hewing of wood" in civil engineering tasks and for unskilled occupations in other branches. In more limited numbers, craftsmen in carpentry, masonry, and iron-work were obtainable from neighbouring regions, and these men became satisfactory at their own trades in the Company's service. All other trades, and tradesmen, were non-existent; and in those early days the Company was compelled to introduce workers from many parts of the world outside Persia. Drillers were brought from America and Poland, pipe-screwers from Canada, constructional engineers from Great Britain, and technicians, clerks, artisans and others from India and Burmah.

In the period immediately before, during, and after the war, the rapidly accelerating momentum of the Company's activities made it essential that development in Persia should proceed at the highest possible pace. Trained labour had to be obtained, no matter whence it came. No time and no skilled instructors were available to instil even the rudiments of technical aptitude into the human material available in the various localities where the Company was at work. In 1921 however, when the speed of development was slackening, consideration was given to the training of Persian labour. The only potential workers were, as I have said, wholly uneducated, quite illiterate, and with none of that traditional inherited ability which is developed in generations of artisans. At that stage therefore it was impossible to do more than train them in the most elementary of industrial occupations.

During the years which followed the Company pursued a systematic course towards a continual increase in the number of Persians in its employ. At first the lower grades of skilled labour were "Persianised" and attempts were made to encourage men to rise into higher ranks. These however had necessarily to be staffed by men of at least some small degree of education. In addition therefore to schemes of technical training, the Company devoted itself to providing facilities for education. Elementary schools—and at a later date secondary schools—were subsidized or established; and young Persians, engaged as probationers, learners, or apprentices, were required to attend educational classes at night or as a part of their daily occupation. Contemporaneously with these activities, the Central Government, which had come under the strong and enlightened control of the present Shah, made wider provision for general education by enlarging existing schools and opening new ones in various towns of southern Persia.

In consequence of these educational efforts, the standard of literacy has gradually risen, and for some years it has been possible for the Company to recruit the great majority—amounting to some 90 per cent.—of its employees in Persia from among Persian nationals. Moreover as the human material has improved, so also have the schemes of technical training been widened to embrace virtually every division of the Company's work.

The influence of these educational and training activities would have been great even if it had been restricted solely to individuals in the employ of the Company. In fact however the influence has been vastly more widespread. Various factors may be adduced to substantiate this claim. It is only within very recent years that industry in its modern form has been introduced into Persia; and nascent enterprises everywhere experienced difficulty in finding

skilled and semi-skilled employees. (Their ranks indeed were practically confined to the staff of the Anglo-Persian Oil Company.) The demand for labour elsewhere set up a movement away from the Company's service.

The drift might never have become serious if it had not been stimulated by natural causes, since the conditions of employment and the wages offered by the Company are equal or probably superior to those available elsewhere. Unfortunately the climate of Khuzistan, by reason largely of its oppressive summer heat, is less agreeable than that of other parts of Persia; and the resultant of a climatic thrust and an economic pull has been to draw away large numbers of men, trained by the Company, to more congenial regions of Persia. There, although they have been of no further service to the industry which educated and trained them, they have spread something of their knowledge, skill, competence, and trained habits among populations to whom these accomplishments had been hitherto unknown.

That, in epitome, is one aspect of the human side—particularly as it affects Persian nationals—of the development of Persian oil. A few facts concerning more material affairs may now be quoted.

As I mentioned earlier, oil was struck at Masjid-i-Sulaiman in 1908. Commercial production began in 1912. The field at Haft Kel was discovered in 1928. At these fields 50 and 40 square miles respectively are under active exploitation. Many wells are capable of steady production at a rate ranging as high as 5000 tons a day. One individual well, famous under the number F.7, produced between the years 1911 and 1926 no less than 7 million tons of crude. In all the Anglo-Persian Oil Company has raised 70 million tons of oil from these two fields. At Abadan, where the principal refinery of the Company is situated, 4 square miles of land are required to accommodate the refinery, the tank farm—with a storage capacity of 2 million tons—the loading station and the residential area. The annual throughput of the refinery is approximately 5½ million tons. Finally the number of employees of Persian and other nationalities engaged at the present time in petroleum and ancillary operations in Persia is approximately 17,500, of which roughly 16,000 are of Persian nationality.

Turning from the oilfields and operations of Persia to those of 'Iraq, we find many similarities and various points of difference. The similarities arise from the contiguity of the two countries, the affinities in certain respects of the inhabitants—and more particularly of those of the petroliferous regions themselves—and the factors common to the search for and development of petroleum in any part of the world. The differences are due principally to two causes—the fact that the 'Iraq concession dates from 1925, twenty-four years after the grant of the Persian concession to Mr. D'Arcy; and the greater distance separating the 'Iraq fields from their appropriate outlet to the sea and thence to the highly populated consuming regions of the world.

The 'Iraq Petroleum Company benefited greatly from the first of these differences. Between 1901 and 1925 great progress had been made in all departments of petroleum technology, practice, and equipment. Geology—though still far from being an exact science—had become based upon wider knowledge, sounder principles, and more accurate reasoning. Hence the

View of the Masjid-i-Sulaiman area: oilfields in the centre

Bungalows and offices in the Masjid-i-Sulaiman oilfield area

Road-building in Southern Persia, where the Anglo-Persian Oil Co. has constructed 1600 miles of roads

Aerial view of the Abadan refinery

search for and discovery of oilfields were greatly simplified and their accomplishment expedited. A large body of highly skilled men was available to conduct every phase of operation. Equipment of all kinds, for every purpose, had been brought many stages nearer perfection.

In addressing you to-night I have endeavoured to show that, so far as Persia is concerned, interest in petroleum operations is spread over all branches. Every phase of petroleum activity is there represented; and the Persian industry is, as it were, a microcosm of the petroleum business of the world. In 'Iraq however interest—particularly topical interest—is focused mainly upon the pipe-line system which will transport oil from Kirkuk, east of the Tigris, to the westernmost shores of the Mediterranean. It is upon that feature that I propose to concentrate in speaking to you of 'Iraq.

Prior to the construction of the pipe-line, it was decided, for various reasons, that the line should debouch at two points on the Mediterranean, Haifa to the south and Tripoli to the north. For 156 miles from Kirkuk to Haditha on the Euphrates, the two sections of the line run together. At Haditha they bifurcate. The southern section continues through 'Iraq, Trans-Jordan, and Palestine to Haifa. The northern section leaves 'Iraq near Abu Kamal, thence traversing Syria to its point of termination at Tripoli. The distance along the pipe-line route from Kirkuk to Haifa is 620 miles, and from Kirkuk to Tripoli 530 miles—an aggregate of 1150 miles.

Almost the entire route of the pipe-line system lies in desert wastes, unequipped with roads or railways, possessing few towns, and unpopulated save for scattered tribes of nomads. Water existed at certain points, but was inadequate in quantity or quality. The preliminary operations of surveying possible routes and determining those which were ultimately chosen occupied, as you may imagine, a considerable number of months. Finally, decision was made and preparations for the work were put in hand.

The country through which the pipe-lines run may be generically described as a desert. Its nature however differs from section to section. Between Kirkuk and the Tigris few geographical difficulties were encountered, but the approaches both to this river and to the Euphrates are rough on either bank and called for some engineering ingenuity in their negotiation. From Haditha through Rutba and as far as Burqa, a distance of some 270 miles, the obstacles to pipe-line construction were limited to stretches of rather rough country, occasional patches of rolling stony ground, and a few small wadis. From Burqa to Jebel Asfar the line traverses its most difficult section. Between these points there lie 70 miles of "lava country." The surface of the ground is covered with basaltic rock which in some places takes the form of a solid sheet and in others—the greater part—exists as boulders varying from 6 inches to 1 yard in diameter. The sand beneath the boulders is loose and abrasive.

At this point I might mention that transport across the lava country was found to be practically impossible, and it became necessary later to construct a metalled road across it in order to facilitate transport of materials from the Mediterranean to the inner desert regions of 'Iraq. The road is 90 miles long and sufficiently wide to accommodate two lines of heavy traffic.

From Jebel Asfar the pipe-line turns to a west-north-westerly direction,

traverses flat country to Mafraq, and then enters limestone hills of increasing heights as it approaches the River Jordan. At its highest point, 18 miles east of the Jordan, the pipe-line is 2600 feet above sea-level. When it reaches the Jordan it has fallen 3450 feet to 850 feet below sea-level; and in a further 10 miles it rises again to 750 feet above the sea. Thence it falls in a steady slope through the plain of Esdralon to Haifa on the Bay of Acre.

The northern section of the line encounters no obstacle comparable in magnitude to the lava country crossed by the southern line. From Haditha to Palmyra the northern route traverses ground which is stony or rocky, broken by occasional deep wadis, notably the Wadi Ratqa, 92 miles from Haditha. The elevation of the line rises gradually as far as Palmyra and thence climbs steeply from 1250 feet above sea-level to 2000 feet, over a rocky saddle in the hills. The climb continues, more gently, as far as El Furklus, where it reaches 2600 feet and proceeds through stony limestone hills falling fairly sharply as far as the valley of the Orontes whence, after a final rise from 1600 feet to 1750 feet, the line drops gradually to its termination at Tripoli.

So much for geographical factors and features. We may now turn our attention to the operations involved in laying the pipe-line.

The aggregate length of the two sections of the line, as you will remember, is 1150 miles. The weight of the pipe required was 120,000 tons—approximately 100 tons a mile. It is evident that the transport of this quantity of steel tubing, and of the appurtenances to the pipe-line, was in itself a tremendous task. If further figures are needed to suggest its magnitude the fact that some 22 million ton-miles of transport were involved should suffice to fill the gap. The transport of heavy materials over desert regions is far from being a simple operation. The surface varies, being composed in some areas of loose sand, in others of irrigated farm land, limestone grit, or boulders of lava. On several occasions during winter a large part of the desert becomes a morass for days at a time and transport is impossible.

In addition to difficulties such as these, two rivers—the Tigris and Euphrates —flow across the track of the pipe-line; and, since they are unbridged, called for special methods of negotiation. Ferries were out of the question because, during the spring floods when the mountain snows are melting, the current is too swift for the safe navigation of considerable loads.

At both rivers a "Blondin," or overhead cable-way, was erected. Steel towers standing on concrete foundations were erected to support a steel ropeway over the river. Across this cable—which was nearly 7 inches in circumference—loads as great as 10 tons could be lifted from one bank and deposited on the other. When necessary a lorry complete with its load could be carried across the river without disturbance of its contents and allowed to proceed with a minimum of delay. The span between the towers, in the case of each river, was nearly 2000 feet; and in order to permit the passage of river craft and to make allowance for the sagging of the cable during hot weather, the towers were of considerable height—130 feet for those beside the Euphrates and 140 feet on the Tigris.

I have mentioned these matters of detail in order to give you some conception of the great amount of preparatory work which was necessary before the laying of the pipe-line could commence. Transport operations began three

months before the arrival of the men who were to perform the actual welding of the pipe. The time was none too long!

Difficulties of all kinds were encountered. Flooding delayed operations repeatedly. At times, lack of security from attack by wandering tribes made it necessary for vehicles to travel in convoy, guarded by an armed escort. Passage across the lava country was extremely difficult at all times owing to the blinding and suffocating dust which rose around each vehicle. Drivers were blinded for hours on end by a travelling dust cloud which prevented them from seeing more than a yard or two ahead. The engines and transmissions of lorries were cut up by abrasive dust. Nevertheless the preliminary work was done; and in due course sections of pipe were "strung" along the route which the line was to follow.

It had been decided for various technical reasons that the pipe-line should be buried throughout its length. The first operation therefore was the digging of an adequate trench. Fortunately little manual labour was required for the task, or we should never have arrived at its end. Most of the work was done by ditching machines. These consist of a caterpillar tractor bearing a power unit which operates an excavating wheel overhanging the rear of the unit. The wheel is equipped with steel buckets which pick up the soil—including boulders of 15 inches in diameter—and drop it on to a conveyer belt which throws it neatly and continuously beside the excavated trench. The type of ditcher used by the 'Iraq Petroleum Company is capable of cutting a trench over 2 feet wide and 6 feet deep at an average rate of approximately a mile a day. (I will leave those who have a taste for calculation to decide the cubic quantity of earth which that represents.)

In places the ground, being composed of rock, was too hard for a ditching machine to operate. Recourse was had to blasting. A line of holes was drilled by pneumatic machines of the type which may be seen any day at work in the streets of London. Explosive charges were placed in each hole and the line of charges, fifty or more, was fired simultaneously. The blasting and the operation of the ditching machines formed a remarkable spectacle, and the proximity to the pipe-line route of many great works of antiquity made one wonder how those were accomplished with only manual labour for power and primitive implements for mechanism. The contrast was inspiring.

The scene was now set for the next act—the welding of the sections. The pipe used by the 'Iraq Petroleum Company was supplied in 40-foot lengths. (The inquisitive calculator may work out for himself how many lengths go to 1150 miles.) The ends of each section were expanded, or swelled, to accommodate a sleeve which fitted into the adjacent ends of two contiguous sections, the effect being similar to the junction of two pieces of rubber tubing by slipping the ends over a metal union. The sleeve facilitated joining the pipe and was so constructed that the interior of the pipe was of constant diameter throughout. Thus there is no obstacle to free passage of the oil through the pipe-line. In addition, the presence of a sleeve at each joint prevented the formation during welding of "tear drops," which in the aggregate would have caused a serious increase in the flow-resistance of the line as a whole.

When welding was about to start ten or eleven 40-foot lengths of pipe were lined up. Each joint was "tack-welded" at three points to provide a first bond

between two sections. These were then rotated and the complete welding was performed in two revolutions of the pipe, the area to be welded being turned uppermost to enable the welder to work always in an upright position.

In due, and rapid, course a 400-foot length of pipe was prepared ready for junction with the remainder of the line and for deposit in the trench. Evidently at the point of junction it was impossible for the line to be rotated for the convenience of the welder. At such a point therefore a pit was dug beneath the line and a highly skilled welder carried out the final operation of adding yet another length of pipe to make up the 1150-mile line. Thereafter the welding gang, composed of 12 welders and some 300 general labourers, moved on.

The metal of which the pipes are composed is steel. In several regions through which the line passes the soil contains corrosive salts which would speedily eat into bare metal. Measures had to be taken therefore to guard against corrosion, and as soon as a section of the line had been welded protective substances were applied. A mechanical cleaner fitted with rotating brushes—first wire, then coir—was drawn along the pipe. The wire brushes removed all dirt and rust, leaving a clean steel surface on which the coir brushes deposited a coating of "primer." When that had dried, a protective enamel was applied by hand. Hot enamel was ladled on to the upper side of the pipe, and, as it ran down, was spread evenly by a strip of canvas passed under and around the pipe and worked backwards and forwards, a remarkably even distribution being obtained. Finally, the entire pipe was wrapped in asbestos.

By this time some of you may be wondering what was done to provide for the inevitable expansion and contraction of such great lengths of metal in a land where temperatures vary so widely between day and night and summer and winter. At the stage which I have reached in describing the laying of the pipe-line, there might be a mile or so of welded line ready to be laid in its trench. At points about 70 yards apart, the pipe would be seen to be supported on skids above the level of the ground. Between those points the line drooped into the bottom of the trench. In effect therefore the section of pipe-line was longer than the trench into which it was to be fitted. If however it could be accommodated in the trench it would be under compression and allowance would have been made for a certain degree of contraction.

This theoretical solution of the problem had to be translated into practice. Evidently the pipe would not fall easily at all points into a trench which was slightly too short. It had therefore to be coerced. The skids were removed, and, at places where the pipe rose above its determined level, it was forced down by loaded caterpillar tractors. The soil remaining at the side of the trench was rapidly replaced to keep the pipe down. When all was finished the pipe lay securely at the bottom of its trench, providing a smooth transit for the passage of oil, protected from corrosion, and immune from vagaries of temperature.

After the completion of operations a slight disturbance of the ground marked the route of the pipe-line. So far as the eye could see, there stretched an apparently interminable row of telegraph posts, running without deviation from horizon to horizon. Between the posts copper wires glinted in the sun. Elsewhere the desert remained unaffected and untouched. Nevertheless the

Crater used by local inhabitants to collect crude oil from a seepage

Rig of a rotary-drilled well at Tul-Bazun

Trail of the completed 'Iraq pipe-line

'Iraq Petroleum Company pipe-line in the Jordan valley

passage of modern industry has left its mark. The posts and the wires form a track, visible for many miles on the surface or from the air, which, if followed by a traveller from Haifa or Tripoli, would inevitably lead to the Euphrates—to water, shelter, and roads. Never before has a path across the desert been so plainly marked.

The pipe-line will lie in its trench for many years, and at twelve points on its course there will be pumping stations staffed by Europeans, Americans, and Arabs which, in a sense, will be nuclei of western civilized life. At these points also wells have been drilled for water. The supplies at present obtained may not be more than adequate for the requirements of the stations themselves, but the discovery of water in an arid and unproductive region is an accomplishment of note. I do not say that from now onwards the desert will flourish, but I do say that from this beginning a new era may be dated. What its potentialities will be, none of us can yet assess.

In the sphere of human affairs also the operations of the 'Iraq Petroleum Company must have left an impress. Some fourteen to fifteen thousand local inhabitants have been employed on the various works of construction. They have learned, for the first time, something of sanitation and personal hygiene, and have been taught that the traditional customs of their tribes are not the rules which guide the rest of mankind. Preventive and prophylactic medicines have been introduced to them, with such a result that sickness among the Company's staff accounted only for a loss of half of one per cent. of men-days. Adequate feeding raised their strength and stamina to a point far above their normal level. Men of various nationalities and religious denominations—among whom contact frequently means instant trouble—have worked together without disturbance.

All this, surely, must be productive of some good. I feel that the distant future historian of the Middle East when he reaches the period of the twentieth century may well head his opening chapter with the title "Petroleum in the Middle East." That historian will have many changes to record.

Sociologically the period now proceeding, and the years which are to follow, will be of great interest. Men who were formerly nomadic tribesmen, agriculturists, labourers, and craftsmen of relatively primitive skill, have become engaged in the multifarious activities of a modern and progressive industry. Education has been improved, and training which leads to skilled artisanship has become available.

In the economic sphere the effect of oil in the countries which produce it is to widen the basis of trade, increase the national revenue, and bring money into the country by means of general expenditure and through the wages paid to all classes of employees.

In addition to these influences, petroleum and the other industries which are in process of development in the Middle East are introducing new factors into the problems of government and compelling readjustment of traditional methods of ruling to accord with the changing circumstances of the populations controlled. The adage that "East is East and West is West, and never the twain shall meet" may well be disproved, appropriately enough, by the Middle East. In that region we now have the very old and the very new in close juxtaposition. Immediate harmony between the two is not to be expected;

but the Governments of Persia and 'Iraq are handling their problems with wisdom and foresight. Many difficulties other than those which they have yet encountered will doubtless arise and will call for high qualities of statesmanship. I firmly believe however that those Governments will prove equal to their tasks, and that the Middle Eastern history of the near future will be a record of steady progress sociologically, economically, and politically.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: I am sure Sir John Cadman needs little introduction, for of late years he has become a public character, and those of you who read your newspapers must see him frequently mentioned in connection with some important event. He is Chairman of the Directors both of the Anglo-Persian Oil Company and of the 'Iraq Petroleum Company. He and I have been friends for close on twenty years. Just before the War he came out to the Gulf at the time when H.M. Government was thinking of taking up a share in the Anglo-Persian Oil Company, that courageous action of Mr. Winston Churchill for which we can really never be too grateful. I was serving in the Gulf in those years and saw the Anglo-Persian Oil Company grow from its very beginnings. Every time in after years that I passed the refinery at Abadan I saw it growing bigger and bigger, and it had become an enormous organization by the time the Great War broke out.

I well remember that when it was announced that the Government had taken a share in the Anglo-Persian Oil Company there were all sorts of rumours in the newspapers that individuals among H.M. Ministers had shares in the concern. One of the yarns current was that Lord Kitchener had a large private holding in the Company. As this was a very undesirable story going the rounds at the beginning of the War some friends of mine went to Somerset House to see what the rumour was based on, and they found that a relation of Lord Kitchener's had £50 in the concern. That was the origin of the whole story.

As to Sir John Cadman, he was a Professor of Geology in the University of Birmingham until 1913, when he went out with other representatives, Admiral Slade and others, to go into the question of the Government's share in the Anglo-Persian Oil Company. Since then he has risen higher and higher and now, as I told you, he is Chairman of both Companies. He is also a Director of the Suez Canal Company and of the Great Western Railway. You will therefore realize that he is an extraordinarily busy man and it is very good of him to give up his time to come and read us a paper this evening. The petroleum question undoubtedly has a great influence in one way or another on geography, especially human geography; for instance, the transference to arid tracts of large communities of workers and drillers entirely changes the face of the country and the habits of the natives. In many ways in that sort of direction the petroleum industry has a geographical interest. But apart from geography we hope to see some interesting illustrations of the progress of the great organization work which is now associated with those two Companies. I will ask Sir John Cadman to address you.

Sir John Cadman then read the paper printed above, and a discussion followed.

The PRESIDENT: We have with us this evening the diplomatic representatives of the two countries concerned, Persia and 'Iraq. I will ask Ja'far Pasha to come up and offer a few words of comment.

JA'FAR PASHA AL ASKERI: I cannot say very much after what Sir John Cadman has said to you, for I am not qualified to speak on the technical and geological

aspects of the matter. I will however tell you what happened when Sir John Cadman and I were negotiating the problem of the concession. I was in Baghdad at the time, and while there to negotiate with Sir John Cadman I was suffering from kidney trouble. When I saw Sir John I told him I was not going to enter into details with regard to technical matters, how he was going to build, and so on, but I wanted to know how much he was going to give me. I said, "Money and nothing else." We argued up and down and I finished with the question of money. Then I went into hospital. Sir John was very kind and considerate.

You have heard what he said about the friendly relations that now exist, and I do not believe that nowadays we can isolate the different countries from each other. The world is gradually growing smaller and smaller. I recently read that in old times people could not get to Dover in less than three days, but now it is possible to fly from England to Baghdad in two and a half days. The world is now becoming so small that we have to work together more and more rather than to regard each other as separate nations or countries. I believe your great economist, Adam Smith, was right when he spoke of the division of labour. We have to do our part and you have to do your part, but we have all to work together. God bless you all.

The PRESIDENT: I will now call on the Persian Chargé d'Affaires to say a few words.

Mons. MOHAMMAD KHAN SCHÂYESTEH: I am gratified that during my short stay in England I have realized that the people of this country are conversant with present conditions in Persia, and that they regard with sympathy and appreciation the hard work being done and the efforts made towards progress in my country. This is, of course, due to the friendly relations which have happily existed between our two countries for such a long time past, and the sympathetic feeling towards us of the English nation, which is most assuredly leading to still closer understanding and permanent consummation of our mutual friendship. Happily a number of sincere friends of Persia are gathered here to-night, and Lord Lamington, one of our oldest friends, is with us.

Sir John Cadman, who so ably manages the affairs of the Anglo-Persian Oil Company, and who so satisfactorily and with great foresight settled last year the differences between the Imperial Government and the Company, has delivered a very interesting lecture here to-night. With regard to the technical side of his speech, on which I am not qualified to express an opinion, I can only say how I admire it.

He said certain things about recent progress in Persia. I can only say that, not only because I am a Persian, but purely from an impartial point of view, the progress and development effected in Persia during the last thirteen years has been quite phenomenal, considering the comparatively short time in which it has taken place. The importance of the services rendered under the leadership and auspices of our beloved Sovereign in the various fields of Politics, Economics, and Social and Judicial progress merit, I think, great appreciation and unstinted admiration.

Mr. Chairman, I am deeply thankful to you for the opportunity you have so kindly afforded me to say these few words on this interesting occasion, and I am grateful to all present for the indulgence they have shown in listening to me.

The PRESIDENT: I am sure we all realize better than we did before what a colossal work has been done in the carrying out of these two great schemes. You will see, as I do, what enormous results the activities about which we have heard may have in the future. Imagine a long tract of country, about 1000 miles of absolute desert, which may become populated and its entire face altered by the progress which these two great Companies are making. I cannot help this

evening thinking of my old friend Lord Greenway who, in the early history of the enterprise, played such a vital part in getting the concession persevered with in spite of opposition. Now in the autumn of his busy life he is unable to come to London so much as of yore; and I much wish that he had been here to listen to Sir John Cadman's address.

I only wish Sir John Cadman, as Chairman of these two great concerns, health, strength, and long life to control and conduct their activities. The Persian Chargé d'Affaires has most gracefully touched upon the amicable way in which all those who were employed by the 'Iraq Petroleum Company have worked together over the matter of the pipe-line. One hears that from all sides. One can only wish that those principles of friendly co-operation could be applied more freely than they are at present in international relationships.

I ask you now to join me in thanking Sir John Cadman very much indeed for his delightful address and wishing him long life to continue his great task.

Sir JOHN CADMAN: I am flattered by the kind words of your Chairman, Sir Percy Cox. I am grateful to him for mentioning my beloved predecessor. I too am sorry he is not here this evening. Of course I do not forget the part which he played in carrying the Company through its childhood to the satisfactory state in which it is at present.

It has been a great pleasure to me to tell you this story to-night, and I am particularly grateful to H.E. Ja'far Pasha and the Persian Chargé d'Affaires for the kind words they have used in expressing their appreciation; I thank you all very much.

A POLISH EXPEDITION TO THE HIGH ANDES

S. W. DASZYNSKI

FOR several years Polish mountaineers had been anxious to go farther afield than the Tatra and the Alps, and especially to gain experience of high altitudes. And we naturally preferred a region that had been little explored. After some consideration we chose the Andes of the Argentine as the field of our first distant expedition of the Climbing Club, which is a branch of the Tatra Society.

The Polish Mountaineering and Scientific Expedition was prepared and organized principally by the Tatra Society of Poland, assisted by official bodies such as the University of Warsaw, the Polish Overseas League, etc., and by private initiative of the members of the expedition.

Some difficulty was encountered at first in assembling a group of men who would not only be experienced alpinists and would pass the severe physical tests, but who also were capable of carrying out the necessary scientific work. Finally six members were chosen, and the party, consisting of Messrs. K. Narkiewicz-Jodko, leader of the expedition; S. W. Daszynski, geologist; J. K. Dorawski, doctor; A. Karpinski, meteorologist; S. Osiecki, in charge of cinema work; and W. Ostrowski, photographer; left Poland at the beginning of November 1933.

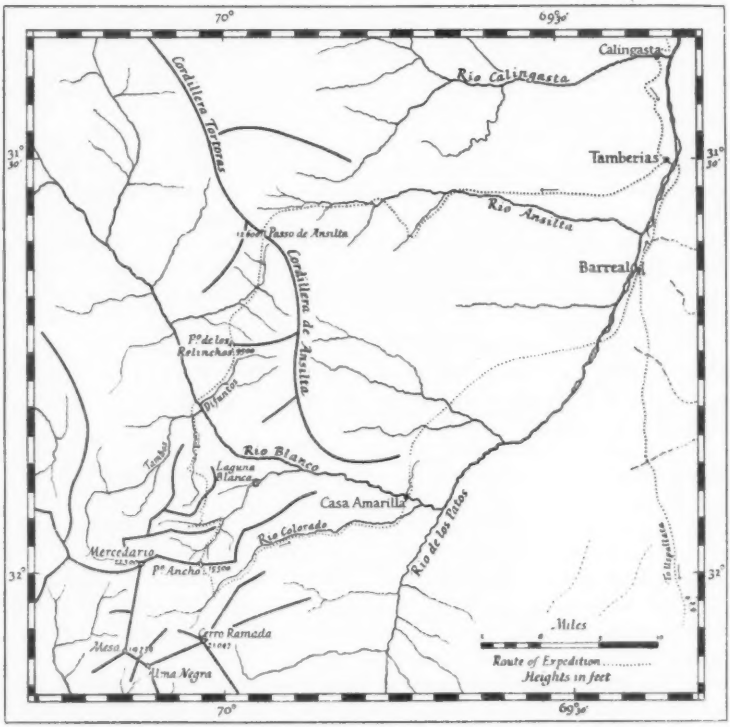
The programme included the exploration of the hitherto little-known group of mountains called the Cordillera de la Ramada in the Province of San Juan, and climbing all the principal peaks of that region. A second objective was to climb the Aconcagua by a new route, if possible.

The scientific work consisted of: (1) mapping the unexplored and little-known parts of the covered territory; (2) geological exploration, mainly investigating the tectonics and stratigraphy, palaeontology, and petrology of the region; (3) meteorological observation, such as temperatures, atmospheric pressures, humidity, the cooling capacity of the air, and its relation to altitude, wind directions and velocities, clouds, etc.; (4) research on the influence of high altitude upon the heart, blood pressure, and respiration, and qualitative and quantitative changes of red and white blood corpuscles. During the sea voyage from England to Buenos Aires and back a study of the intensity of cosmic rays in relation to geographical latitude. Results of the above studies will be published in due time. During the expedition some 12,000 feet of standard film were exposed to record all activities and over 2000 photographs were taken.

The question of equipment and food was thoroughly planned for almost a year before the expedition proceeded to the mountains. The party was to be entirely cut off from civilization for a period of nearly three months, mostly in severe atmospheric conditions. In order to secure proper shelter for all altitudes, three kinds of tents were used: one large (18×12 feet) tent for working bases in lower altitudes; three small army tents for two persons each for intermediate and exploration camps; and three small very light silk tents for two, specially designed with insulating sheet of air between the double walls and floors made of balloon material. The total weight of each silk tent

with aluminium pegs and posts did not exceed 2·8 kg. Two kinds of sleeping-bags were used: single bags for the lower tents and very light double bags made of threefold coating material and two kinds of stuffing for higher altitudes. The double bags weighed only 2·5 kg.

All the clothing was made exclusively of silk and wool. For very cold weather suits of impregnated windproof material were used. The hats were designed to protect from the frost as well as from the sun, which was very intense, especially on the glaciers. Every member was equipped against cold and



Route of the Polish Expedition to the Cordillera de la Ramada

strong winds with a mask which fitted into a sort of aviator's cap under the hat. The boots, which, like most of the equipment, were designed by Mr. A. Karpinski, proved to be of great value. They were made of canvas and had leather soles with 3-cm. spikes screwed into them. The object of this was to get away from the generally used climbing irons, which are a frequent cause of frostbitten toes, because of the straps which hamper the movements of toes and free circulation of blood. These boots were put over two pairs of woollen socks, a soft leather slipper, and a soft felt shoe, and could be interchanged with a similar boot with nails instead of spikes.

Silk tent erected beneath Mercedario

Boot specially designed for glacier climbing

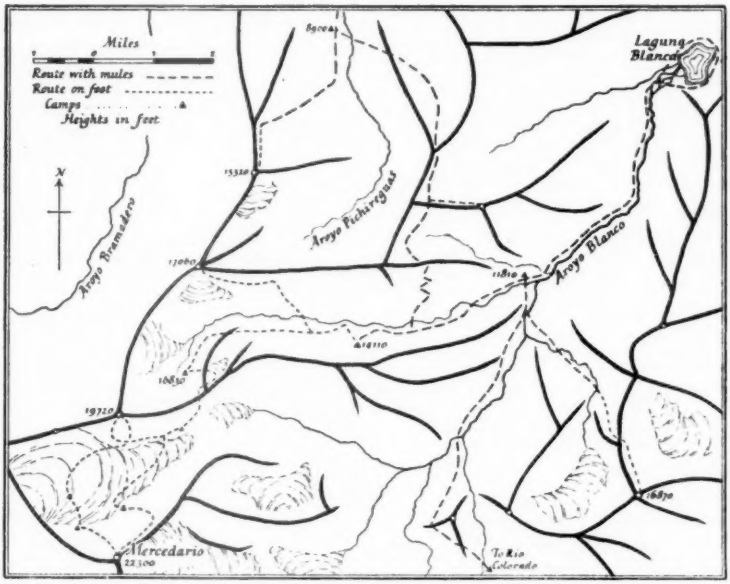
All photographs copyright by the Polish Scientific Alpinistic Expedition to the Andes

Cerro Ramada

Valley of the Colorado with "Innominata" (left) and Mercedario (right)

The food supplies were canned meats, vegetable, butter and fats, cakes and dry-bread, dry meats and fruit, Glaxo dry milk, etc. Occasionally there was fresh meat from the few guanacos we shot, which proved to be excellent in eating. At the altitudes not exceeding 10,000 feet the sturdy roots of a small plant were used as fuel for cooking. Higher up Primus stoves were used, and still higher the Meta-alcohol tablets and special burners.

The necessary formalities, arrangements, and purchases in Buenos Aires lasted two weeks. The expedition started on December 23 by rail to San Juan, the capital of the province of the same name, in which lies the Cordillera de la Ramada. After having spent three days in San Juan the party proceeded by motor car to Calingasta and Tamberias over a very mountainous motor road



The approach to Mercedario

along the valley of the river San Juan. In Tamberias the Government of San Juan very kindly supplied the expedition with a caravan of twenty-five mules with four experienced mule-men and guides and the necessary pack and riding saddles. It was necessary to leave behind part of the baggage as the pack-mules could not carry the entire load of 3000 lb. of food, equipment, and instruments.

On December 29 our caravan started on the long trek of about 100 kilometres leading to the Cordillera de la Ramada. The journey lasted four days. We followed at first the broad valley of the Los Patos river and then to the west into the Cordillera de Ansilta, which we had to cross in order to approach the northern slopes of Mercedario, the highest mountain of the Ramada group. At first the caravan followed the narrow canyons of the Ansilta river,

which broadened later into wide valleys. The first pass to be crossed was the Passo de Ansilta, approximately 12,600 feet, leading to the Fierro Valley of the south-west side. The second pass, Portezuelo de los Relinchos, about 9500 feet, brought us to the valley of Difuntos which ended at the river Rio Blanco. We crossed the river without many difficulties and entered the valley Pichireguas through the valley Bramadero. At Pichireguas the first camp was established at an elevation of approximately 8900 feet. From here, after a few days of rest, some of the mules with two men were sent for the rest of our supplies and the members of the expedition commenced reconnaissance trips with the objective of finding the easiest way for climbing the Mercedario and also a site for a base camp nearer to the foot of the mountain. At this point ended the territory known to our guides, and official maps showed great empty spaces to the south of us.

The party split into three groups of two, and several climbs over 13,000 feet were made on mule back and on foot. From the photographs and sketches obtained during this trip it was decided to attack Mercedario from the north, and the required base much nearer to the foot of the mountain was found. One party found also a suitable road for the mules for conveying the base camp farther to the south. On January 5 parts of the equipment and the base tent were shifted to the new location on the north-eastern slopes of Mercedario, at a height of approximately 14,100 feet. Further advance by mules was unfortunately checked by large fields of *nieves penitentes*. At a later period in the summer however a base could be established another 2000 feet high. From here the mules and mule-men were sent down towards the Laguna Blanca to an elevation of about 11,800 feet, where there was enough grass for the animals and fuel-root *lena* for cooking. The men received orders to establish a camp and to wait for the rest of our stores from Tamberias, which were due to arrive in about five days. The members of the expedition proceeded to find the way to the summit, which was still not clear, being hidden behind a long high ridge running east–west. A series of trips was undertaken to the neighbouring peaks, and the previous assumptions proved to be right: the easiest access to the Mercedario was from the north. There remained only a question of choosing a time when good atmospheric conditions prevailed, and preparing the loads to be carried by each of the members.

On January 15 all six men started the attack, each member carrying about 45 lb. of food and fuel for eight days, tents and sleeping-bags, clothing, two cine-cameras and film, photographic cameras, and instruments.

The first night was spent at an elevation of only 16,800 feet, in order not to overstrain the heart during the first day. The route led first over a steep step of about 800 feet, and later along a very wide trough, rising fairly gently to the west, and finally turning towards the south and ending with a small glacier. The heavy loads were tiring every one, so that the next day the loads were curtailed by a few kilogrammes, by leaving some dispensable parts of equipment and food at camp No. 1. Two of the members chose to proceed onward with the whole load, the two other pairs preferring to take their load to the next camp in two instalments. On January 16 all three pairs reached an elevation of approximately 19,000 feet, the one pair with complete load established a camp, while the other two left their half loads and went back to spend the

Looking north from the slopes of Mercedario

On the lower part of the glacier of Aconcagua

On the lower part of the glacier of Aconcagua

night at camp No. 1. The route on that day led over very steep slopes of loose rocks, very tiring for advancing. Camp No. 2 was placed on the edge of a huge glacier which fills the sloping plateau on the north side of Mercedario. Next day the three parties met at noon and decided to cross the glacier by two different routes, and establish the next camp as high as possible on the rocky slopes on the other side. The glacier at this elevation was quite easy to traverse, the crevasses were few and uncovered, not giving any technical difficulties. Progress was slow however because all the men of the party were at such a high elevation for the first time, and every one wanted to keep his strength for the final attack of the summit. The first pair put up their tent at 20,000 feet, the second party a few hundred feet lower, about three-quarters of a mile farther west, and the third had to spend the night on the glacier, as the sun went down before they could traverse the ice.

The temperature at 8 o'clock p.m. fell to −16° C. Atmospheric pressure and the corresponding shortage of oxygen caused a feeling of exertion with the slightest movement. Erecting the tent, preparing the dinner, and getting ready for sleep had to be done by instalments with long rests in between. The night passed quite peacefully, although the weather, which was perfect until then, started to show signs of change. On the morning of January 18 the two pairs, Daszynski-Osiecki and Karpinski-Ostrowski, started on the last lap of the route to the summit. The third pair decided not to go farther because one of the members was rather exhausted after an uncomfortable night. The barometer showed a fall of 2 mm., and few clouds appeared on the horizon, so that the two advancing parties decided not to join each other as previously arranged, but to proceed each by the shortest way to the peak, before the storm, which was to be expected. The routes of the two parties did not prove technically difficult, but were very tiring owing to the small stones slipping from under the feet with every step on the steep slopes. The clouds gathered more and more. The first to reach the peak at about 3 o'clock were Karpinski and Ostrowski, by the shorter route; they made the necessary measurements and took photographs. By this time the storm was already raging over the whole south-east, and was rapidly approaching Mercedario. After erecting a cairn and after leaving cards with names and dates, the first party decided not to wait for the others, who were coming along the north-east crest, and they rushed down to the camp. Daszynski and Osiecki were caught by the storm and reached the summit three-quarters of an hour later. By this time the fresh snow was already 2 to 3 inches deep, falling heavily, driven by a strong south-east wind. Electric sparks were continually discharged from any point of clothing and metal. Whenever there was thunder a few miles away, both men experienced a slight shock along the spine. Mr. Osiecki, who took the cinematograph pictures, had electrical discharges between his eyelashes and the camera. In these circumstances the party did not stay very long on the summit, and after leaving their cards in a tin box, and adding a few stones to the cairn, hurried down to the comparative safety of the tent some 2000 feet lower. The tent was found to be covered by about 4 inches of snow, and the snow still falling.

The first ascent of Mercedario was achieved. The measurements, after the necessary corrections made later, estimated the height as approximately

22,300 feet (6800 metres), which makes Mercedario probably the second highest mountain of America. Next day all descended to the base camp. The weather, which up to January 18 had been very good, changed, and a series of snowstorms and wind followed for almost a month, the mornings usually being very fine and the afternoons cloudy and snowing.

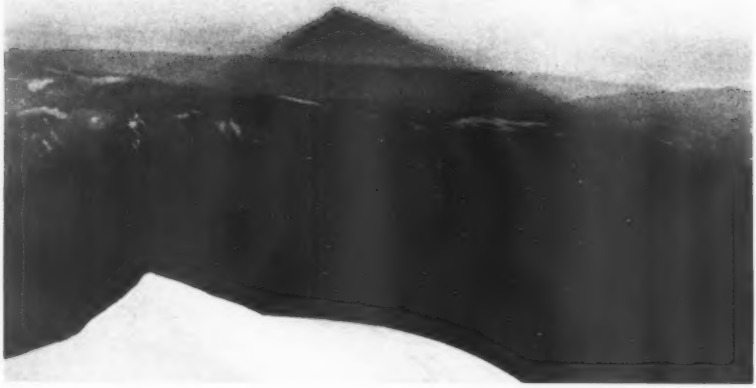
On January 23 the base camp was transferred to an elevation of 11,800 feet in the valley of Aroyo Blanco, where the mule-men were waiting. From this camp a number of explorations were made to find a suitable pass for the whole party to proceed farther to the south into the centre of the Cordillera de la Ramada. Cerro Wanda (16,850 feet) and Cerro Negro (18,000 feet) were climbed and named by the expedition during the course of mapping. On January 27 camp was shifted past the newly discovered Passo Ancho (approximately 15,500 feet) into the valley of Rio Colorado, and the new centre for the operations in the Ramada was established at an elevation of 12,000 feet. The new camp was situated in perhaps the most beautiful and magnificent surroundings encountered by the expedition in the Andes. The head of the Colorado river is surrounded by a panorama of high mountains and enormous glaciers. Starting from the north is Cerro Negro, west of it Mercedario, south of it a peak without a name called by the expedition for the sake of convenience "Innominata." Farther to the south is Mesa, south-east of it Alma Negra, and finally to the east Cerro Ramada. Some of the nine glaciers which descend into the Colorado valley are 8 to 10 kilometres in length.

The activities of the expedition were slowed down by the weather which continued to be bad. Nevertheless the following climbs were made: on February 1 Daszynski attempted the first climb of Cerro Ramada by reaching on mule-back an elevation of 19,500 feet, and then on foot 20,250 feet, when he was driven back by the storm and descended to the base camp in one day. The next day Narkiewicz reached a height of 18,400 feet on mules, and after sending his mules down spent the night there. On February 3 he reached the summit of Cerro Ramada (21,047 feet), and after a second night in the same place descended to the base on mules which were sent to fetch him. On February 8 Dorawski and Ostrowski proceeded on mules to the Ramada pass, where they established a camp at 16,200 feet. Next day they climbed the Alma Negra (20,050 feet) by the north rocky slopes and glacier, and descended to the camp on the pass. The following day the party started for the Mesa, reached a culminating point on the crest (19,734 feet), but because of the late time of the day and heavy snowfall was forced to return to the camp. After another night on the pass the party returned to the base.

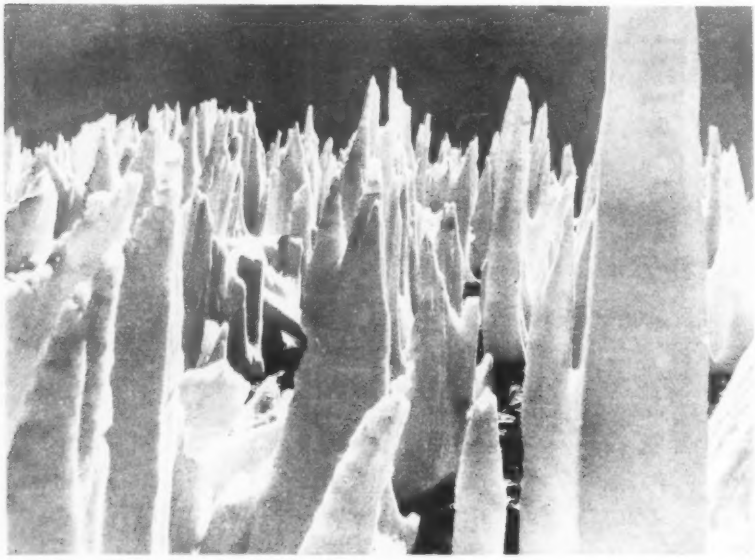
On February 9 a group composed of Daszynski, Osiecki, Karpinski, and Narkiewicz started for the Innominata, which was so far unknown to geographers, being well hidden from the north by Mercedario and from the south by the Mesa. The first night was spent on the glacier descending from a pass between the Mercedario and Innominata. The whole of the next day was spent in reaching the pass, some 1500 feet higher, over a very steep glacier covered with *nieves penitentes;* progress was naturally very slow. The night was spent on the pass (17,750 feet) in a deep crevasse in the glacier. On the following day the party proceeded to advance over the difficult northern crest, leading from the pass to the summit. The approach from this side seemed more

North-east face of Aconcagua from the Valle de los Relinchos

Looking west towards Mesa (left) and Innominata (right)



Shadow of Aconcagua thrown against the evening haze: photographed from the summit



Nieves penitentes

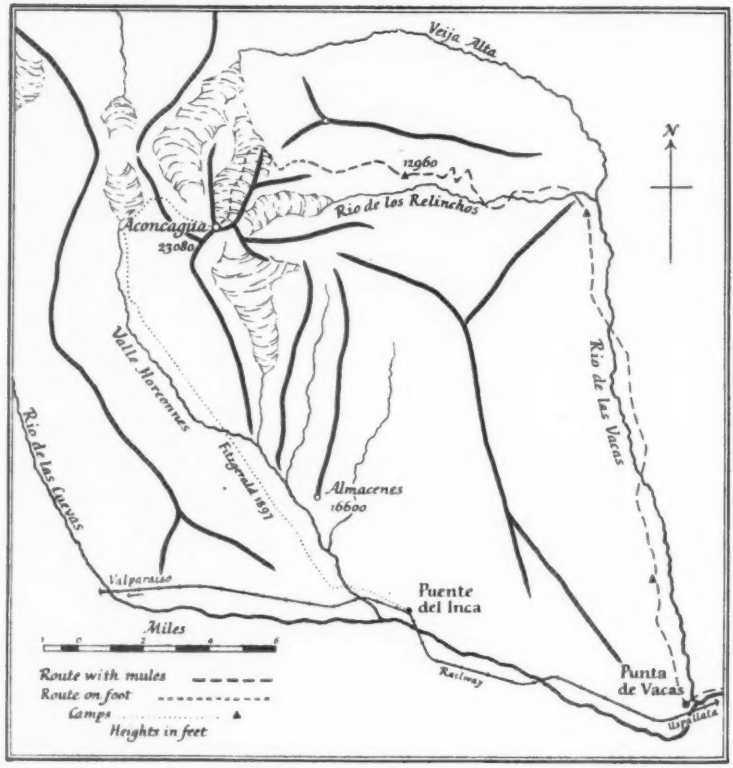
impossible, as the party advanced for five hours, and retreat was decided after Osiecki's foot was injured by a falling block of rock. The next day, owing to continuous heavy snowfall, the party abandoned the attempt on Innominata, and returned to the base.

The last ascent in the Ramada was made by Karpinski, who again climbed Cerro Ramada, but this time also its lower southern peak. This concluded the mountaineering programme of the expedition in the Cordillera de la Ramada. All the peaks were climbed for the first time and mapped to a fair degree of accuracy. Cairns were erected on the summits of Mercedario, Cerro Ramada, and Alma Negra.

There remained only the last point of the programme, the climbing of the Aconcagua, which was some 80 miles in a straight line to the south of the Ramada. The return journey, which lasted five days, took us along the beautiful valley of the river Colorado to Casa Amarilla, near the junction of the Colorado and Blanco rivers. This is the nearest inhabited place to the Ramada. From there we passed through Barreal along the Los Patos river to Tamberias and Calingasta, where the caravan was disbanded. In Calingasta we hoped to load our baggage on lorries and go back by motor car to San Juan, then by rail to Mendoza and Uspallata, whence we were to start for the Aconcagua. This plan however had to be abandoned because a revolution had broken out in San Juan, the day before our arrival in Calingasta. Telegraphic communications were destroyed. News of street fighting, of the wounded governor, and of the many dead and wounded, was brought by people who managed to leave the town by motor car. We decided therefore to avoid San Juan by going directly to Uspallata in the lorry over a rough road on the plateau between the Precordillera and the Cordillera de Tigre. With some difficulty a lorry was hired and the whole party and baggage reached Uspallata in two days. Three of the members remained in Uspallata and three went to Mendoza for new supplies for the Aconcagua climb. Osiecki, whose foot was still aching after the Innominata mishap, had to be X-rayed to make sure that no bones were broken. Fortunately everything proved to be in order. After a few days the whole party gathered again in Uspallata, where in the meantime the small caravan of fifteen mules and two men had been assembled by the management of the Estancias Uspallata. After consulting the local men and studying the maps the expedition decided to try Aconcagua from the east. So far all expeditions, of which seven were successful, had followed the easy north-western route from Puente del Inca, discovered first by the Fitzgerald Expedition in 1897.

The mule caravan started on March 1 by a road to Punta de Vacas and was joined there next day by the members, who arrived by motor. From Punta de Vacas the whole party proceeded on mule-back up the valley of the Rio de las Vacas and the Relinchos valley to the eastern slopes of Aconcagua. On March 4 a base camp was established at a height of approximately 12,000 feet. The actual attack began next day, on mule-back to about 16,000 feet, and then on foot to about 18,000 feet, where the first night was spent. Progress was rather slow the next day, as the route had to be first discovered, and several unsuccessful attempts were made before a route over a steep rocky barrier on the north-eastern face of the mountain was found. The second night was

spent at approximately 19,400 feet. On March 7 the party crossed the barrier to the huge glacier on the north-east side of Aconcagua and climbed it to a height of 20,800 feet. Here two groups put up their tents in an ice cave of the glacier, and the third group which climbed on that day without their loads returned for the night to the previous camp. On March 8 the two groups of the highest camp started the final attack. Between us and the summit were over 2000 feet of steep ice and snow. The view of the route ahead was frequently obscured by the uneven glacier surface. Progress was very slow owing to the



The approach to Aconcagua

many crevasses and the necessity of cutting steps which exhausted the members of the party. Fortunately the weather was very good, and the worst enemy of the mountaineer, the wind, not very strong. After eight hours of climbing the two groups, composed of Daszynski and Osiecki, Narkiewicz and Ostrowski, reached the summit of the highest mountain of America, at 6 o'clock p.m.

At the cairn we discovered that on the same day, only a few hours earlier, four members of an Italian expedition with a lieutenant of the Argentine Army had climbed Aconcagua by the old Fitzgerald route from the north-west. Con-

forming with the established custom of Aconcagua we took the ice-pick of the last expedition and left one of ours with cards and description of the route. A cinematographic panorama and a series of pictures were taken with some difficulty owing to the intense frost.

To the west the horizon of the Pacific Ocean with the sun going down was just faintly visible; to the east the shadow of Aconcagua was reflected in the distant haze in mid-air, like an enormous phantom pyramid; and as far as the eye could reach around and beneath us were masses of mountains like colossal motionless waves. There was but little time for gazing at this unforgettable scene. The sun was going down quickly, and so was the temperature, which until then had kept about 15 centigrades below zero. We had to hurry to make the most of our descent in daylight.

At first all four of us kept together in descending, each pair using one rope. About 8 o'clock, when darkness enveloped us, the pair Narkiewicz–Ostrowski decided to find a sheltered place in the glacier and spend the night there. Daszynski and Osiecki resolved to reach the tent by the light of the stars and moon, which was due to rise about 1 o'clock in the morning. The descent was very slow and tiresome owing to the steepness of the glacier and the crevasses, which were difficult to traverse in darkness. In this way, although very tired, we were kept warm by the exercise. The tent was finally reached at 2.30 in the morning. The other pair, after spending the night sitting in an ice cave at about 22,000 feet, reached the tent at 4 o'clock next afternoon. Narkiewicz had unfortunately had his hands and feet frostbitten, and as a result the little finger of his left hand had to be amputated a few weeks later. The first pair continued the descent after the arrival of the second one. The second party wanted to spend one more night in the camp on the glacier in order to rest after the strenuous night, and followed next day. The whole descent lasted two and three days respectively. After all had assembled again at the base camp, one day's rest was taken, and the whole caravan proceeded to Uspallata by the same route. There the caravan was dissolved and the mountaineering expedition finished.

Owing to the destruction of the Trans-Andine Railroad by the disastrous flood of last January the journey from Uspallata to Mendoza had to be done by motor car, and from Mendoza by rail to Buenos Aires, where the whole party embarked for Europe.

THE EAST AFRICAN ARC OF MERIDIAN: *A paper read at the Afternoon Meeting of the Society on 9 April 1934, by*

BT.-MAJOR M. HOTINE, R.E.

"SUCH a continuous chain of triangulation, if carried through the heart of Africa, would afford to every traveller, explorer, and surveyor points of departure which would give to his labours a precision and value that could be reached in no other way."

"To every Protectorate (and the proposed line traverses the boundaries of most of the Protectorates) the triangles of this great Arc of Meridian would afford a basis for the surveys which will ultimately be found necessary for administrative purposes. . . ."

These brief extracts from the writings of Sir David Gill, the originator of the project for a backbone of ruling triangulation in the neighbourhood of the 30th Meridian throughout Africa, serve to show its main purpose more clearly than any words of mine could do. In addition, the completion of the trans-Continental triangulation and its connection to existing surveys in Europe and Palestine would provide the longest possible continuous series of geodetic measurements for improving our knowledge of the shape and dimensions of Earth. But this subsidiary scientific object, although the basis of all metrical investigation of the constitution of the Earth and of astronomical distances, should not blind us to the more pressing economic uses of the triangulation as a means of assisting ordered Colonial development. Gill knew well the danger of killing a good case by overloading it with evidence: "The question has an important scientific side also, but that cannot probably appeal to you in the present state of your finances."

Until recently there remained two gaps in the 30th Meridian triangulation: (1) The "Tanganyika Gap," consisting of about 100 miles in North-Eastern Rhodesia, the whole of Tanganyika Territory, and the Belgian mandated territories of Ruanda-Urundi; (2) the "Sudan Gap," consisting of about 150 miles in Northern Uganda and the whole of the Sudan.

A party of one other officer and two non-commissioned officers under my command arrived in Tanganyika at the end of November 1931 to carry the triangulation through the British territory in the first gap and had completed measurement astride the Belgian frontier, a total of about 360 miles, by March 1933. After that we were employed for a further few months on base measurement in Southern Rhodesia and in running a cross chain, illustrated on the accompanying diagram, between Mbeya and Kambole.

North of Kigoma, an administrative centre on which the party was first based, the country traversed by the arc is mainly a grass-covered plateau about 2500 feet above the level of Lake Tanganyika, or about 5000 feet above the sea. The slopes of the plateau running down to the lake and to the flat country traversed by the Central Railway are covered with thin bush with occasional patches of thick rain forest in the gullies on the higher hillsides. A deep rift runs parallel to the coast down to Kigoma. To the west of this rift is a range of sharp low hills falling almost sheer into the lake—pleasant enough camp sites on a fine day between the unruffled waters of Tanganyika and the rolling

plateau, but somewhat precarious in the sudden nocturnal gales which are a feature of this country in the rainy season.

The inhabitants of this fair plateau of Buha are Waha. They are pastoral and predatory, argumentative and still rather inclined to violence. For clothing they wear a skin—which, with entire disregard for propriety, is preferably used to keep the head dry—a snuff bag, and a mile or two of telegraph wire from the railway. Lusimbi, an aged chief to the north of Kigoma, can still remember the palmy days when he would dispatch raiding parties across the present frontier in search of Warundi cattle and women. The Germans apparently did not seriously interfere with these pleasurable and profitable pursuits, but he finds British rule altogether too improving.

Ujiji, the old tribal centre and slave depot, is now the seat of the Bishop of the Tanganyika Diocese of the Mission des Pères Blancs, a collection of men (and women, for many of the larger missions have a nursing and teaching staff of "White Sisters") to whom nothing seems impossible except leave to Europe. Here the site of the historic Stanley-Livingstone meeting is marked with an obelisk, and a plaque presented by this Society, but the traditional mango tree no longer stands.

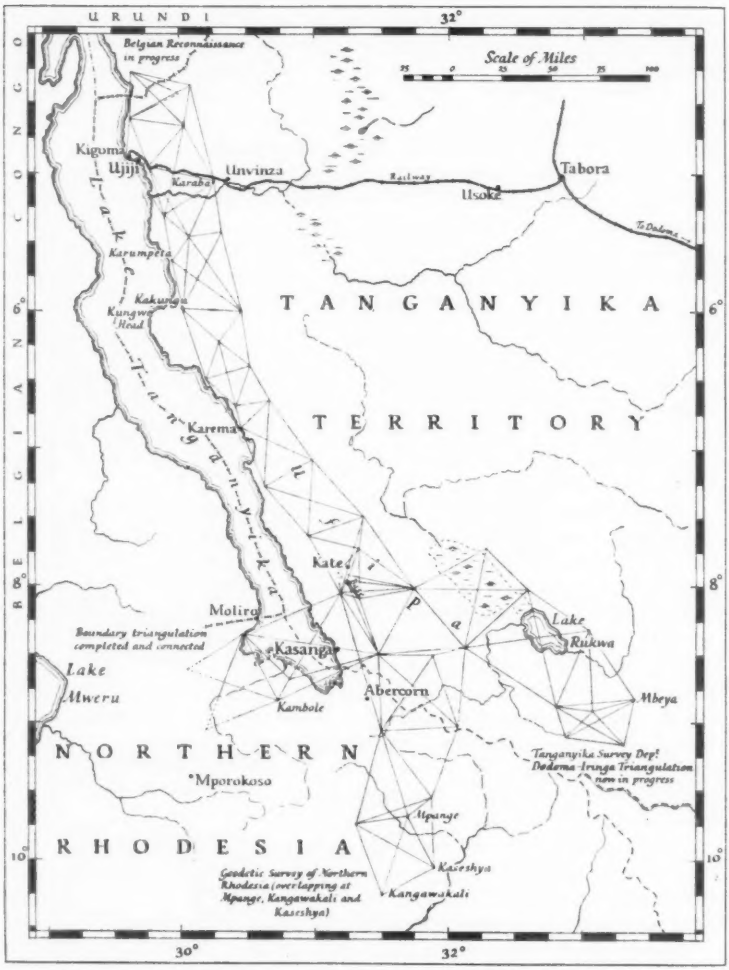
The lake-level has sunk considerably since those days, to an extent which can be seen clearly from a sketch in the possession of Ujiji Mission, but I am not qualified to express an opinion as to whether this is due to desiccation or a breach. Ujiji, at one time a dhow port, is now high and dry, while Karema, the oldest mission in Central Africa and originally built near the shore, is now almost a mile inland.

Between Kigoma and Karema is a tsetse fly belt of *miombo* forest, occasionally thick but usually open and stunted like the tree savannah of Northern Rhodesia. Again, the general formation is a deeply eroded plateau, but lower and far more broken. A belt of dead bamboo forest intervenes about the latitude of Kungwe Head, the ear of land jutting into the lake near Kakungu. According to native report the bamboo all died suddenly in one year, about 1928, a year of no unusual climatic conditions according to the natives. It is difficult to understand why this should be so in a country where everything else is so much alive and biting. Perhaps the new ecologists will venture an explanation. From a distant hill-top, the dead bamboo looks pleasantly like purple heather, but this illusion is rapidly dispelled soon after attempting to journey across country through it. With the possible exception of the "buffalo bean," that silky haired pod which robs the unwary of sleep, it is the finest practical joke in Africa; in forcing a way through the standing stems, a foot placed sharply on one end of a fallen cane lying hidden in the grass will ensure a sharp attack in front or in rear from the other end, whereas muddy boots in the middle of a cane mean a certain fall.

The only local native who even claimed to have climbed Karurumpeta refused to go there. He had been there, so he said, to look for a tree from which to make a canoe and had found a crater on the top full of dead elephant, with two very live ones on sentry duty at the entrance who promptly charged him. This sounded very much like one of those mythical burial grounds in which some of the old hunters had hoped to find the "mother vein" of ivory, but unfortunately there is not even a crater on the top. Really good ideas are rare

among the Wabende and an inspiration such as this would soon get itself talked into an article of faith.

This part of the country is very sparsely populated—fair centres of population near Kakungu and in the rice areas of the Karema flats, a very few miserable



Triangulation work of the East African Geodetic Survey 1931–1933

fishing villages on the lake, occasional small villages on the Uvinza (near Karaba) to Karema track, and nothing between. One member of the party prospecting the high ground on the east in an apparently uninhabited area stumbled on a small village with painted witch-doctor in full session, but

elsewhere the inhabitants do not just hide themselves—they simply do not exist. For this the marriage customs of the Watongwe and Wabende, who cannot afford a legitimate wife until they are old men, is probably responsible, although disease—which however is hardly a separate factor—and slave-raiding may have played their part.

This stretch boasts the highest mountain in the area—Kungwe, to the west of Kakungu. According to native report this has never been climbed, although I should imagine Charles Grey or Grant would have done so if they had even suspected there was any reputed difficulty. It would not have been a suitable station for us, although we have of course fixed it, and, being no higher than 8000 feet or so, would not offer any inducement to a special expedition.

South of Karema rises the thickly populated grass-lands of the Ufipa Plateau with its backbone and flanks of impressive bare hills. One day, when communications improve, this may be an important mineral and agricultural area. There one may see the white communities of missionary, administrator, and settler (in chronological order) and remain singularly unimpressed by the usual arguments of some of them against the others. In Ufipa at least they live more or less in harmony.

The Kate base line by sheer bad luck happened to cross a pile of charred human bones, which on investigation proved to be the remains of a woman whose spirit was reputed to have caused her husband to die "of a chest" and whose awful wailings at night were rapidly killing her father, to whom alone they were audible. The trouble had been overcome, to the satisfaction of every one concerned and at the modest price of two cows, by calling in a witch doctor to exhume and burn the body. But pagan carriers employed on the base measurement utterly refused to go near the remains. Christians were eventually persuaded to do so, but their general attitude was that although they did not disbelieve me, and still less the "Bwana Father," there was clearly no sense in taking any chances. After all we *might* be wrong. I discussed this with the Father Superior of the nearest Mission, who had only once left the country in about thirty years, and shall never forget his remarks. "My son, witchcraft in this country is thousands of years old; Christianity a bare thirty. These people will run after a snake and away from the harmless remains of a witch. If you and I had lived with snakes and witches for as long, we should do the same." The influence of such men whose whole lives have been devoted continuously to a study of the native and to an improvement in his conditions, and who are certainly not there for any selfish purpose, must be all to the good. Most administrators who have served throughout the fifteen years of the life of Tanganyika Territory realize this and are glad enough of the advice of such men, but a few of the younger generation of administrators and settlers are sometimes mistrustful or even violently in opposition. Certainly the Ufipa Missions at least do not treat the native as either an equal or a slave, and would thereby be entitled to misrepresentation from both extremes.

Farther south, the country shelves down to the more featureless bush-covered landscape of Northern Rhodesia. Abercorn, to which our base had been moved during the southward reconnaissance safari, is the centre of a considerable white settlement of the friendliest people in the world. Here we

were able to use motor transport to supplement carriers, on whom we had to rely entirely in Tanganyika except for the conveyance of base stores by lake steamer. The roads, it is true, are far less passable than the open country in England, but the transport is operated by a firm of pioneers who have a continuous record of getting loads through somehow whatever the conditions. The British Empire has not yet entirely settled down to a life of easy old age.

The flora and fauna of this delightful country I am not qualified to discuss. The flora we chopped down in order to see and the fauna we killed in order to live. Game is not plentiful except for the commoner forms of buck which it is no pleasure to shoot. The only dangerous game which can be shot in the course of a rapid march between stations, followed by a few hours' computing, are crocodile and snakes. Although one frequently hears lion at night, I have seen only two outside the Zoo and the motion-picture industry, and one of them, which put the camp into an uproar one night, was probably a hyena. Nevertheless the lion is the stock excuse for the Central African native. For instance, a native rear-light party on the return observing safari was delayed in leaving its station, and the excuse for this was that a lion had killed in the neighbourhood and all the carriers had departed to get some of the meat. Since the sole reaction of the Wabende on hearing a lion is to build a large fire and shiver over it, the idea of the intrepid hunters fighting the beast for a share of the kill could only be considered the week's best story, but nevertheless minor variations of the same theme are usually tried first.

With the technical aspects of our work I do not propose to deal here in any great detail, and would recommend any one interested to read a series of articles which are appearing in current numbers of the *Empire Survey Review*. A general outline, followed by a few bald statements for the technical surveyor, may however be of interest.

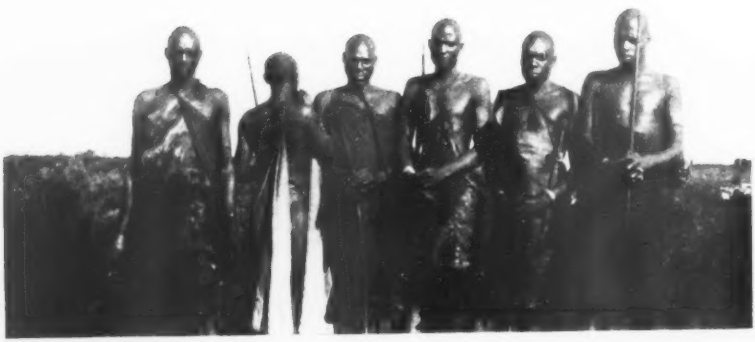
The first problem is to decide on a suitable choice of stations which are intervisible and form the apices of well-shaped geometrical figures. This operation of preliminary reconnaissance was carried out in one walk through the country, usually by two parties working abreast in signal communication and preparing a rough map of all the salient topographic features. The difficulty here is not so much technical—although that requires a carefully planned operation to ensure the best result in this type of country—but administrative. For this we were fortunate in being granted the assistance of an officer of the Tanganyika Administration. A native carrier will eat his own load in about twenty days, and the problem of supply along indefinite routes through little-known and sparsely inhabited country will decide the choice of technical method. Moreover it is possible to rely on only about three months in the year of clear enough visibility for reconnaissance, after which the periodic African haze intervenes and limits visibility of natural objects to less than 5 miles. It is possible to continue measurement on luminous beacons of a properly reconnoitred chain during the haze, but unless the reconnaissance has been provided in advance it is possible to do nothing at all. Since, for financial reasons, the whole chain had to be completely measured in little more than a year, it is obvious that no more than one bite could be taken at the reconnaissance cherry.

Looking from Ipumba towards Kakungu in the rainy season

Mwanza station prepared for observing

Typical fishing village on Lake Tanganyika

A native rear-light party



Waha carriers

The next step, undertaken during the return journey northwards, was measurement of all angles, horizontal and vertical, with theodolites, of which three were used—a $5\frac{1}{2}$-inch Tavistock by Cooke, Troughton, and Simms, which gave reliable and satisfactory service throughout, a Wild geodetic instrument which developed axis trouble and had to be discarded, and an 8-inch reflecting instrument by Cooke, Troughton, and Simms which gave satisfactory results although more cumbersome in use than the modern single-reading instruments. Owing to the haze, the indefinite nature of the topographic background, and the difficulty in transporting or improvising materials, opaque targets erected over the station centres could not be used. Instead, observations were made to heliographs or electric beacon lamps which were aligned and directed in the required directions by theodolite. The general organization was two forward parties under the command of the two non-commissioned officers for station preparation and emplacement of lights, followed by the two officers as observers working more or less abreast. The observers left native parties in charge of the rear lights, which were recalled when observations were complete and sent forward. All this would be quite straightforward but for delays by cloud and storm, with a dwindling food supply, interruption by locusts and ants, and the difficulty of communicating in a fog across trackless bush.

The next operation, undertaken during triangular measurement, was the measurement of frequent astronomical latitudes and azimuths to secure emplacement of the chain as a whole on the surface of the Earth. Longitudes also would have been of great scientific value in this deeply rifted area, but we could not afford them. During the return journey, linear measurement of the Kate base, 12 miles in length, was carried out by invar tapes in catenary. Unfortunately the gear could not be supplied in time for use during the most convenient period, with the result that the triangular measurement—at that stage a slow process to heliographs only in persistent cloud and through the worst of the haze—had to be continued past the base site. This implied some delay and a return journey.

The first gap referred to earlier in this paper has now been filled with the exception of about 180 miles of Belgian territory. At the moment this is being reconnoitred by a Belgian party who, it is hoped, will shortly be strengthened for measurement. The Sudan gap of about 1300 miles is as yet untouched, and several ribs from the backbone will be required in Rhodesia and in the East African colonies before their surveys can be permanently founded.

Work of this nature requires extensive training, equipment, and organization, and can only be carried through economically on a continuous basis. Intermittent efforts followed by long periods of inaction and a fresh start must result in loss of experience and high overhead costs in the fundamental triangulation itself, while the bill for rectifying temporary floating surveys, which wait on its completion for finality, grows longer every year. The former point will need no elaboration to any one who has attempted to make bricks with African straw. To make the second point clearer, let me provide some concrete examples from recent work. Before our triangulation had even been observed it had to be used as a basis for controlling the local survey of the British South Africa Company's Tanganyika Estate, and temporary values

were accordingly computed in the field as a simple extension of the old triangulation before the local survey could proceed at all. In the same way, temporary values of the spur which you see crossing the south end of Lake Tanganyika had to be provided for the Rhodesia–Congo boundary survey then in progress. Both of these surveys are now clamouring for "final" results on which to compile their definitive records. We cannot provide them. As successive bits are added to the trans-continental triangulation it will become necessary to readjust the whole, and with it these and any other surveys dependent on it. If this state of affairs persists for long, the confusion which will eventually arise hardly bears contemplation. Yet another example is the Tanganyika oblique arc from Arusha to Mbeya which has itself been undertaken to avoid the waste and confusion which arises from independent farm surveys. This oblique arc will shortly reach the Mbeya spur of our triangulation, which was run out to meet it, and will then require final values of position, scale, and orientation to stabilize its records and the records of other surveys based on it. There is no immediate prospect of these final values being available. The state of local surveys in the territories not yet traversed by the trans-continental triangulation is even worse. There, in addition to alteration of records, it will be necessary to bear the cost of extra field work, in many cases amounting to re-survey, before finality can be secured.

The lack of such a fundamental triangulation gave the "land shark" his opportunity in America; it has led to countless boundary disputes all over the world; it has introduced so much confusion in certain European surveys as to necessitate complete re-survey, which is now proceeding; it has made it impossible to provide topographic mapping quickly and cheaply and of lasting value, and the lack of this essential information has in turn led to wasteful development of communications and natural resources in all of the "new" countries. To quote Sir David Gill once more:

"There is one, and only one, remedy for all this, and that is to connect all detached surveys with a general system of triangulation—and it will save the Government and the inhabitants generally a vast amount of money to establish this triangulation as quickly as possible. . . . With the universal experience of the civilized world at my back I do not hesitate to say that it is waste and extravagance to postpone the commencement of a principal triangulation of your country."

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: The idea of the African arc of meridian originated about 1890 with Sir David Gill, who was Her Majesty's Astronomer at the Cape, and carried out the geodetic survey of South Africa. It was a great conception of his to extend the Arc right through Africa, and with the aid of Cecil Rhodes and the Chartered Company he carried it to within 70 miles of Tanganyika. Major Hotine has only recently returned from commanding a small party of British officers who started out more than two years ago, and have carried forward this great African arc of meridian from the point where it had been left by Gill. It had been hoped that it would be possible to bridge the gap from where Gill left the triangulation in Rhodesia and the Arc on Uganda–Congo boundary, measured under the direction of Brigadier (then Captain) Jack in 1910. Fate however was unkind, and the economic crisis made it impossible to secure the necessary funds from

the Governments concerned. Although a substantial portion of the gap has been closed there is still a piece remaining to be done. But it is satisfactory to see progress being made in an enterprise to which this Society contributed a substantial sum twenty-four years ago. We are interested in the matter from two points of view: first of all, we consider it of great importance to provide a strong backbone to which all surveys in Africa can be articulated—that is the particular and local interest; and secondly we have always kept in mind the greater purpose of making a contribution of the first importance to our knowledge of the figure of the Earth.

The subject is rather a technical one, and I do not feel competent to discuss its technical aspects. I will content myself with this brief explanation of the lecture to which we are going to listen, and will call upon Major Hotine to deliver it.

Major Hotine then read the paper printed above, and a discussion followed.

The PRESIDENT: Col. MacLeod, the head of the Geographical Section of the War Office, is present, and I shall be glad if he will make a few comments on the lecture.

Col. M. N. MACLEOD: Major Hotine, before he went out on this expedition, served under my command at the War Office, and throughout the whole of his recent work we have of course kept in very close touch with what he has been doing. He has submitted to us not only official reports, but very voluminous unofficial letters, which, I might mention, are very much more interesting and worth reading than the official documents.

I should like to take this opportunity of making a few observations on the financial aspects of geodetic triangulation. Geodetic triangulation serves the same purpose in survey work as the steel framework does in a modern building. If you provide a sound and strong framework you can use cheaper and quicker methods for the rest of the building. Now, as you know, in the last century the European Powers partitioned the continent of Africa among themselves, and one would have hoped that by this time they would have got busy and have made considerable progress with the surveys of the territories they acquired. You cannot develop any country without first of all knowing what is there: surveying is the first step in development. Geodetic triangulation, again, is the first step in surveying. Thanks to the foresight of Sir David Gill, and also Cecil Rhodes, who financed Sir David Gill's idea, South Africa is fairly well provided with geodetic triangulation (though not much progress has been made with topographic surveys); but so far as the rest of Africa is concerned it is in a very backward state, and all African surveys have been held up by the almost complete lack of geodetic triangulation on this continent. It is a great misfortune that, after many years of propaganda, when it was at last possible to get all the colonies together and make a fresh start upon it, the financial crisis supervened and closed down the work once more. The fact of the matter is that the places where surveys are most wanted are the poor countries which can least afford them. It is impossible, then, to finance surveys out of current revenues, yet that has been a financial principle which we have followed for a considerable time past. You cannot finance roads or railways or any other development in that way. You have, first of all, to borrow the money, and if there is confidence in the country and its development, there is plenty of money to be borrowed, if it can be applied to a good purpose. No better purpose, no more economical purpose, and none which will give a better return for the money expended, can be imagined than geodetic triangulation.

I do not want to elaborate that theme or to detain you any more. I will only

say that, as you may have inferred from what Major Hotine has said, his was a task of quite exceptional difficulty. There was very little precedent to go upon. We had done no geodetic triangulation in this country for many years, and Major Hotine had to go out into an almost unknown and uninhabited country. He was bound by extremely stringent financial limitations, he had to do the job within a certain specified sum; the sum for which he actually succeeded in doing it was well within—I think it only represented about two-thirds of the amount—the sum which the Germans estimated in pre-war days for the same job. It redounds to his credit that by his drive, forethought, and energy he succeeded in carrying out this difficult bit of work in such an exceedingly competent manner and for such a small sum.

The PRESIDENT: You will be glad to know that Mr. McCaw, who was with Sir David Gill, and took a large part in the survey which started the scheme, is here with us this afternoon, and I should be very grateful if he would say a few words to us.

Mr. G. T. McCAW: Mr. President, Ladies and Gentlemen. It is of the greatest possible interest to me to see this work resumed—work with which I was associated from twenty-five to thirty years ago. We have been hoping for many years to see the Arc continued. While we were working there Tanganyika was in the hands of the Germans, and, as Col. MacLeod has stated, the Germans had given an estimate for the cost of completing that chain. That, unfortunately, was an estimate beyond the capacity of the German Government at the time, however anxious they were to proceed with the work. It must be said however that Helmert's pre-war estimate included the territories of Ruanda and Urundi, which are now part of the Congo, together with a gravity survey. Nevertheless it remains true that the achievement of Major Hotine and his staff has been remarkable, both as regards time and cost.

You have heard this afternoon of the difficulties of carrying on the work. Although the general conditions have changed considerably in the interval of a quarter of a century since I was out there, the great difficulty which we found, and which was also probably Major Hotine's greatest difficulty, was the recurring haze which for over six months of the year blotted out everything in the landscape. To carry on during that haze and get ahead with the job is a matter of extreme difficulty. If, as was unfortunately the case at the beginning of our work, one is dumped, so to speak, into the middle of the haze, and is expected to carry on reconnaissance, the result must be that nothing can be done. In the work of connecting Southern Rhodesia with Northern Rhodesia across the Zambezi valley, it took us five months to get the reconnaissance complete. Even in clear weather, as Major Hotine has made fairly obvious, the difficulty of getting sights with assurance is by no means a small one, but of course if you cannot see it becomes quite impossible.

Another difficulty is that of the commissariat. It is almost impossible to appreciate the difficulties of arranging food in advance, the food to be just where it is wanted at the proper time. Care has to be taken that those who are set to look after the lights are being fed also. A work of this kind therefore requires a great deal of organization over and above the technical execution of the task itself; in fact, the technical execution is a comparatively small part of the job. It means that a large proportion of the surveyor's time, when he is not actually moving from station to station, is expended in making arrangements for the next moves of the various parties in the field; without communication by heliograph the time thus lost would have been vastly increased.

Then there are all sorts of other difficulties. We were not, fortunately, troubled with new administrative regulations so much as one is to-day. We had our boys

supplied to us regularly every two months. That, of course, had objections from many points of view, for as soon as we had got our men fully trained to do the job they had to leave, and the coming of a new supply of carriers, probably from a different tribe, was always an event of some importance to see how they would shape themselves. But, generally speaking, the results were quite satisfactory. It was very important to ensure that the boys who attended to the lights should stick to their job. We too, like the lecturer, had the occasional excuse brought to us that there were lions about, sometimes the boy's mother was ill, perhaps the helio was knocked out of position or its tripod burnt. It is rather interesting that among these people the appeal that was supposed to have the greatest influence on the white man's heart was the plea that the mother was ill; that excuse was proffered to cover all sorts of truancy. However they were very faithful on the whole, and though many mistakes were made, they were in many cases mistakes which were unintentional. We felt very grateful to those boys who remained on the hills and kept our lamps going, because that is so essential in this work.

I must not detain you any longer, but I would just wish to say, following up what Col. MacLeod has already said, that we have been looking forward to the completion of this Arc. The country, with the exception of Ruanda and Urundi, is under our own sway, and the necessity for carrying the Arc through to Uganda is urgent. If we can get this chain through to Uganda we can overcome certain technical difficulties which are still outstanding. We want to hand this chain over to Africa as a framework of lasting stability. But we must have the last joint tied in, and that joint is to be made by carrying the Arc through from where it ends at present to the Arc already measured by Brigadier E. M. Jack, in Uganda.

The PRESIDENT: Major Hotine's second-in-command, Lieut. Urquhart, is with us, and we should like to hear a few words from him.

Lieut. R. W. URQUHART: I must say that I very highly appreciate the honour of being called upon to make a few remarks, but there is very little indeed to add to what Major Hotine has said. Mr. McCaw, amongst others, has paid a tribute to the carriers, and these people certainly deserve mention. You will have already gathered that they are idle devils, but, all the same, they are very pleasant fellows, and I ask you to remember that they had to work for much of the time under the worst of climatic conditions—a thing they are quite unaccustomed to do. They did their work in a remarkably cheerful manner. It is true that occasionally "mother was ill," but many of them came through the country with us in so faithful a way as to evoke our high regard. We are all agreed that this great triangulation should be completed. My own personal experience of the work is that it is a most pleasant form of occupation. The hours are certainly long, but every moment is of some interest.

The PRESIDENT: I should like to call upon Dr. de Graaff Hunter, who has been Director of the Geodetic Branch of the Survey of India, to say a few words.

Dr. DE GRAAFF HUNTER: I am very pleased to be able to add my tribute of praise to the excellent piece of work which Major Hotine and Lieut. Urquhart have been able to complete. In the course of my Indian surveys I have done a certain amount of triangulation myself, and I think I am in a position to appreciate with particular sympathy the kind of difficulties which occur in this kind of work. My own work was in the higher Himalayas, and there the questions of visibility, naturally, did not perplex us to the extent that they have perplexed these workers in East Africa. Yet of course I know that such things occur, and that they have occurred in Major Hotine's case to an extreme extent. The country of which we have seen slides this afternoon looks perfectly dreadful,

and I really wonder how the triangulation has ever been carried through. There was one innovation in their method of working—at any rate, an innovation as compared with the methods we have used in India heretofore—and that is that the party consisted of two observers—incidentally also two N.C.Os. In the Indian Survey we had only one observer, but the employment of a second observer makes it much easier to get over the difficulties of reconnaissance. In fact, I imagine that much of this work could not have been done by a single man.

Major Hotine succeeded in occupying rather more than thirty-five stations; I do not know how long exactly it took him, but thirty-five stations would be a creditable observation programme—apart from reconnaissance—I should say, for three years' work in the case of a single observer in a straightforward country. That he did his work in such a bad country in a shorter time than that seems to me quite remarkable.

Of course, I am in very keen support of what Col. MacLeod has said. It is positively heartbreaking that these things which are so difficult to organize, and for which it is so difficult to acquire the necessary local knowledge, should be carried to the point almost of completion and then abandoned on the ground of finance. It is complete madness—no other word could describe it. Much of the money spent has been thrown away. When triangulation is regarded as an investment, as it should be, then perhaps this mistake will no more be made.

The PRESIDENT: Before closing the debate there are just two questions which I myself should like to ask. The first is, what is ordinarily the length of a side in the triangulation? Secondly, after the triangulation points have been once inserted on the map resulting from the survey, is it necessary that they should be maintained in a distinguishable state afterwards on the ground? Are they liable to be grown over, and what happens to them if the jungle takes its own course and obliterates them?

Major HOTINE: As regards the length of side, we aimed at a chain 30 miles wide in order to provide a reasonable compromise between speed and economy and the ease of subsequently utilizing the triangulation for minor surveys. But for topographic reasons the actual lengths varied between 15 and 70 miles.

Each station is permanently marked with duplicate brass bolts set in concrete and "witnessed" by four small marks set at measured irregular distances and bearings from the main mark. It is essential that these marks should be easily recoverable later, but there is not likely to be any difficulty. Full records are available; the site has been completely cleared and the roots of near trees which might disturb the position of the marks have been removed. Periodic inspection is desirable but, in this case, need not be very frequent. It would of course be a different matter in low-lying areas of tropical forest.

As to whether one or two observers should be used, I think Dr. Hunter will agree that the deciding factor is the state of development of the country. If the communications are easy and rapid, and there is no difficulty in supplies, a single observer would be the most economical arrangement.

The pre-war German estimate for this triangulation has been mentioned. It amounted to 840,000 marks, which, allowing for our omission of the Ruanda–Urundi gap, longitudes, magnetic survey and gravimetry, reduces to the comparable figure of 610,000 marks or about double the amount actually expended by us at a time when unit costs have considerably increased. The only possible explanations are that the German estimators were strangely ignorant of such work—indeed their elaborate proposals for organization and movements based rigidly on a chain of equilateral triangles rather point to this—or that for some obscure reason they wished to kill their own proposal. I cannot claim any credit from a comparison which, if not odious, is inapposite.

I must return thanks for all the compliments which have been paid me this afternoon, but in doing so would like to point out that the officer in charge of such work as this does little more than an equal share and would stand no chance of success without the loyal and energetic support of his party, the assistance of the local Administrations, and the support of the Home authorities. I have purposely refrained from mentioning any names, because I should never end, but nevertheless I am fully conscious of a considerable debt to others.

The PRESIDENT: It only remains for me to wind up the meeting. All who have listened to the lecture will realize what a great work has been going on and of what great importance it is that while we are in a position to control the country we are working over, the work should be carried on to the point where it will join up with the piece of the Arc done by Brigadier Jack. We can realize the truth of the point that has been made that it is of the greatest importance that in new country a geodetic survey should be available on which to base the topographical survey. When a British officer like Major Hotine comes here to give an account of his work from the geographical point of view, there is not time, nor, I dare say, would he wish, to dwell more than very lightly on the difficulties encountered in other directions. But we know very well what it means, as has been stated in the course of the afternoon. The actual work that is before us has only taken a very small proportion of the time occupied in many other worrying ways, not only making the work harder, but making their days anxious and their nights very often—I am sure from my knowledge of the country—sleepless, owing to insects and alarms and other little attentions. We have therefore to pay our tribute to the gallant way in which this job has been carried through.

Major Hotine has now, after being engaged on that work for two years, month in and month out, in that climate, come home to rest, and we hope he is recuperating after what must have been an exhausting time. We hope also that this work is to go on, and that possibly he may be able to return to it himself. We wish Major Hotine all good fortune, and thank him very much for his lecture this afternoon.

THE YUSUFZAI STATE OF SWAT

MAJOR W. R. HAY, C.I.E., I.A.

THE object of this paper is to describe the creation and progress of an autocratically ruled State which since 1917 has come into being in the Tribal Territory on the North-West Frontier of British India—the Yusufzai State of Swat, as it is styled by its founder.

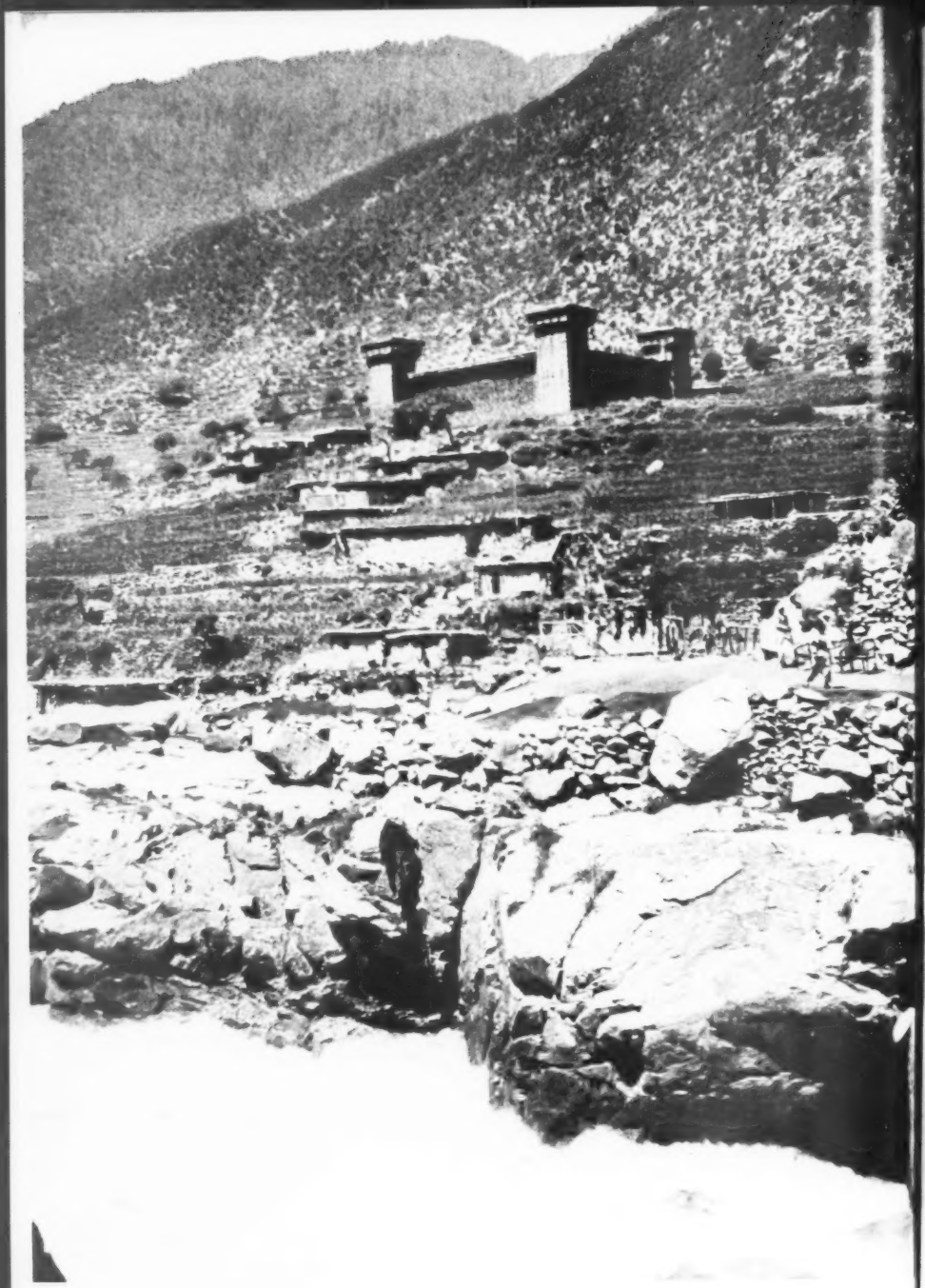
The Pathans, who reside in the tribal territory on our border, are essentially a democratic race, and though from time to time a Khan or Mulla has arisen amongst them who has acquired such influence that he has come to be regarded locally more or less as a King, it is doubtful whether an individual has ever before succeeded in establishing over any part of their country such absolute power as that now enjoyed by the present Ruler of Swat, Miangul Gulshahzada Sir Abdul Wadud, K.B.E. Though his State occupies only a very small portion of the world's surface, its creation is such a unique achievement that a brief description of it may not be considered out of place in the Society's *Journal*.

The Swat valley is rich in historical and archaeological associations. It was the scene of one of Alexander the Great's campaigns and the home of an extensive Buddhist civilization. Almost every spur is crowned with the solid remains of ancient dwellings, while here and there in the side-valleys one suddenly encounters the majestic pile of some old *stupa* gradually crumbling away and covered with grass and bushes. This aspect of the country has however been ably and meticulously described by Sir Aurel Stein in his paper which was published in the Society's *Journal* for November and December 1927, and in his book 'On Alexander's Track to the Indus,' and I shall not therefore deal further with it in the present paper.

During the last few years, by the kindness of the Ruler, I have visited many parts of Swat State by car or on foot, while through the courtesy of the Royal Air Force any parts of the State which I have not visited on the ground I have been able to see from the air. I have also had many long talks with the Ruler and those about him and have learnt direct from them all the recent history of the State and the details of its administration.

The Yusufzai are one of the largest of the Pathan tribes on the North-West Frontier of our Indian Empire. They are divided into two main branches, the descendants of Yusuf and the descendants of his nephew Mandanr. The latter are mostly settled in the Mardan Sub-Division of the Peshawar District in British territory, and we shall only be concerned in this paper with a few of them who occupy a fringe of the hilly country on the northern border of the Swabi Tahsil. The descendants of Yusuf are divided into four branches: the Akozai, who occupy the Panjkora and Swat valleys and some very mountainous country between the Swat valley and the Indus; the Malizai and Iliaszai, who live in Buner and some adjacent country towards the Indus; and the Isazai, who are mostly found on the left bank of the Indus but possess a small slice of country on the right bank of that river. All these sections are divided into numerous sub-sections of which I need only mention the powerful Malizai, a sub-section of the Akozai, who occupy practically the whole of the main Panjkora valley and must not be confused with the Malizai of Buner.

Miangul Gulshahzada Sir Abdul Wadud, K.B.E., Ruler of Swat



Fort at Baranial

The Yusufzai organization—like that of most other Pathan tribes—is based on the theory that all members of the tribe have equal rights while those who are not members have none. Generally speaking, only a member of the tribe can own land, and any person who ceases to own land loses his tribal rights. Further, in the case of the Yusufzai, most, if not all, of the cultivable land belonging to the tribe was originally liable to redistribution *per capita* at fixed periods of years. This practice has mostly fallen into desuetude but is still in force in some parts across the border. The Yusufzai however differ from most other Pathan tribes on the border in the special position held by their Khans. These are presumably descendants of the men who led the tribe when it first conquered its present territory and received special recognition in consequence. They hold a special allotment of land over and above their ordinary tribal share; it is not liable to periodical redistribution, and on the death of a Khan is normally not split up amongst his heirs but passes undivided to his successor as Khan. The most important of these Khans for several generations has been that of Dir.

Possessing a large individual estate and exercising a certain amount of control over the whole of the Malizai in the Panjkora valley, the Khan of Dir has often extended his authority over neighbouring tracts and in particular over the country occupied by other Akozai sections on the right bank of the Swat river. Since the British Government entered into an agreement with the ruling Khan, Muhammad Sharif Khan, in 1895, in connection with the operations which were undertaken for the relief of Chitral, the position of the Khan of Dir has been greatly strengthened and he is now recognized as a hereditary Nawab and the head of a State much of which he rules with more or less autocratic powers. I am not dealing with Dir State in this paper, but it is necessary to refer to it briefly, because it was the effort of the right-bank Swat tribes to throw off the yoke of the Nawab of Dir which gave to Miangul Gulshahzada the opportunity of establishing his own position and founding a State more extensive and far more absolute than that of Dir.

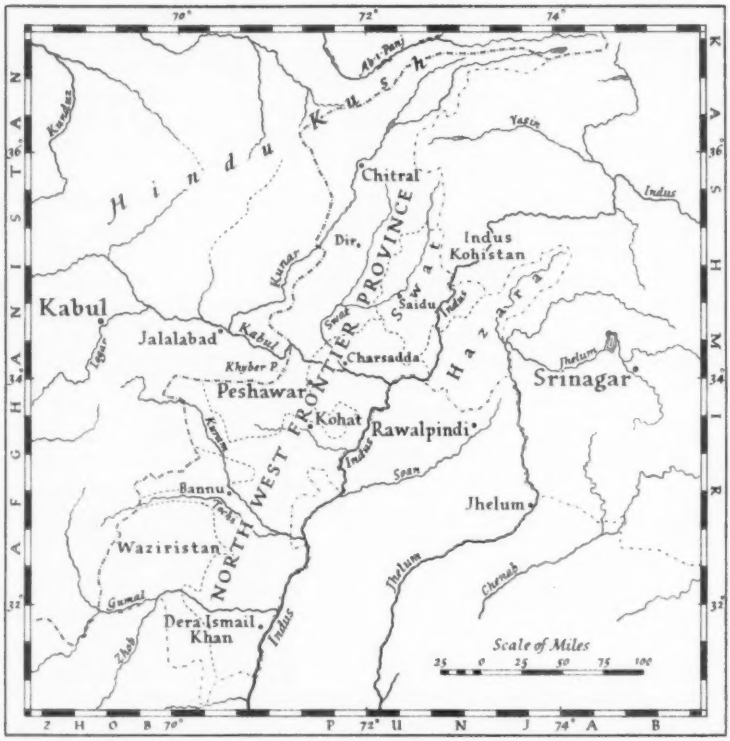
Before proceeding further I will explain the origins of this remarkable man. Some time towards the end of the eighteenth century an ordinary Safi tribesman left his own country on the farther side of Bajaur and settled at a hamlet called Jabrai in Upper Swat. About 1794 a son was born to him called Abdul Ghafur, who as a boy tended flocks and cattle, and when he began to grow up migrated, as many of the Swatis[1] do, to the Peshawar District as a *talib-ul-ilm*, or seeker after religious knowledge. He studied at the feet of various Mullas and eventually settled down as a hermit in a small village near the Indus, where he stayed for twelve years and acquired a great reputation for sanctity.

Local politics at length forced him to migrate, and he wandered about for many years from place to place, until about 1845, when he returned to Swat and settled down at the village of Saidu. Here he remained till his death in 1877. His reputation as a saint rapidly increased and he soon became the leading figure in the valley, being famous all along the frontier as the Akhund

[1] Where I use the word "Swati" I mean an inhabitant of the Swat valley. The name is also applied to a tribe which once had its home in Swat, but now lives on the left bank of the Indus.

of Swat. It was under his lead that the tribes took the field against us during the Ambela campaign of 1863, but apart from this his attitude to the British Government was not generally one of hostility, and his chief anxiety appears to have been to maintain the independence of his beloved Swat. He never aspired to temporal power, but led a simple religious life at his mosque in Saidu, where he was visited by countless pilgrims.

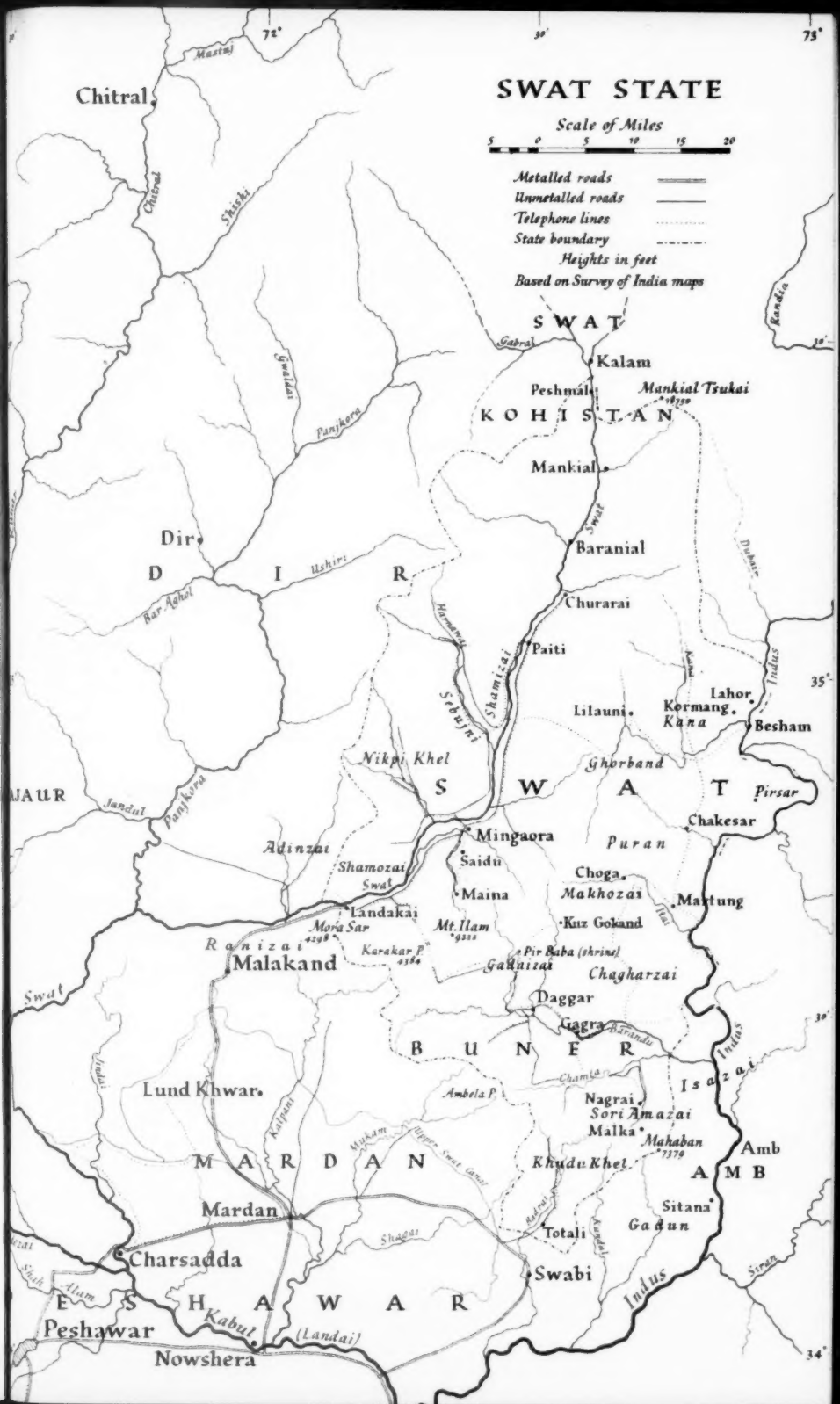
At this time and until the recent rise to power of Miangul Gulshahzada, there was no leading hereditary Khan or Chief in Swat or Buner or any of the



Position of States on the North-West Frontier of India

adjacent Yusufzai territory to the east. There were numerous petty Khans who were always fighting each other and a ruinous sort of party system prevailed. Sometimes one party would be in power and sometimes the other, and the party out of power usually had to abandon its villages and seek refuge elsewhere until it had gained sufficient strength to oust its rivals. These parties were guided by no political principle but purely by self-interest or ancient hereditary attachments. The result of this system was that the whole country was normally in a state of anarchy and chaos.

The Akhund on his death left two sons, Abdul Hanan and Abdul Khaliq,


SWAT STATE
Scale of Miles
5 0 5 10 15 20
Metalled roads
Unmetalled roads
Telephone lines
State boundary
Heights in feet
Based on Survey of India maps
72°
30'
75°
35°
34°
Chitral
Mastuj
Chitral
Shishi
Gwaldai
Panjkora
Kandia
SWAT
Gabral
Kalam
Peshmal
Mankial Tsukai
KOHISTAN
Mankial
Swat
Dir
DIR
Ushiri
Bar Aghol
Baranial
Dubair
Churarai
Harnamak
Paiti
Shamizai
Sebujni
Kana
Indus
Lahor
Kormang
Kana
Lilauni
Besham
Nikpi Khel
Ghorband
SWAT
Pirsar
Jandul
Panjkora
Chakesar
Adinzai
Mingaora
Puran
Shamozai
Swat
Saidu
Choga
Maina
Makhozai
Matrung
Landakai
Mt. Ilam
Kuz Gokand
Mora Sar
Ranizai
Karakar P.
Malakand
Pir Baba (shrine)
Gakuizai
Chagharzai
Swat
Daggar
Gagra
Barandu
BUNER
Indus
Lund Khwar
Ambela P.
Chamla
Isazai
Nagrai
Sori Amazai
Malka
Mahaban
Amb
AMB
MARDAN
Mardan
Khudu Khel
Sitana
Gadun
Totali
Shagai
Charsadda
Swabi
Indus
Siran
ESHAWAR
Kabul
Peshawar
(Landai)
Nowshera

who with their descendants received the appellation of Miangul. Abdul Hanan was ambitious of temporal power and played a prominent part in local party politics, but without achieving his object. Abdul Khaliq led the life of a religious recluse. Abdul Hanan died about 1887 and Abdul Khaliq in 1892. Abdul Hanan left two sons, Said Badshah and Mir Badshah, and Abdul Khaliq two sons, Gulshahzada and Shirin. All were still minors when Abdul Khaliq died in 1892. They soon began intriguing against each other, and the parties in Swat ranged themselves behind rival Mianguls. Said Badshah was murdered by his brother and cousins in 1903 and Mir Badshah was shot dead by Gulshahzada in 1907. The elder branch of the family thus became extinct, but the two brothers Gulshahzada and Shirin continued to intrigue against each other till 1915, when the appearance of a rival in the field forced them to unite.

At this time the Swat tribes were engaged in one of their periodical attempts to free the right bank of their valley from the yoke of the Nawab of Dir, and in order to bring about the union necessary to achieve this object, they determined to take unto themselves a king. Once in the time of the Akhund, when they feared a British invasion, they had a king for a few years, and it was his grandson they now called in, Abdul Jabar Shah, a Saiyid from Sitana in Amb territory on the right bank of the Indus. The Mianguls at once began to work against him, and allied themselves with the Nawab of Dir; they were however defeated and for a time turned out of Saidu. They were soon back again, and it was not long before the Swatis grew tired of Abdul Jabar Shah, who had not proved successful as a leader in the field and being an Ahmadi had come to be regarded as a heretic by the Sunni inhabitants of the valley. In September 1917 they quietly escorted him out of their country and invited the Mianguls to take his place as joint rulers. The Mianguls readily accepted the offer and were not slow in consolidating their position and taking the field against the Nawab of Dir. It was perhaps providential for the future peace of the valley that the younger Miangul, Shirin, was killed in a fight with the Nawab's forces in 1918, and that Gulshahzada was left in sole and undisputed authority.

The Nawab of Dir continued his efforts to reconquer his revolted provinces on the right bank of the Swat river, but in August 1919 he suffered a crushing defeat in the Harnawai valley, as a result of which Gulshahzada was able to eradicate the last remnants of his authority over the right-bank Swat tribes and even to occupy Adinzai, which had long been regarded as an integral part of Dir State, and through which a section of the Chitral road runs. Fighting continued in Adinzai till 1922, when Government was forced to intervene and the Nawab of Dir and Gulshahzada were induced to sign an agreement whereby Adinzai was handed back to the Nawab, and each ruler undertook to refrain from interference in the other's territory. A limit was thus set to the expansion of the new State towards the west. North of the Swat river it marched with Dir State, the boundary from north to south being the main Swat–Panjkora watershed as far as Adinzai, and then a subsidiary watershed running down to the Swat river between Adinzai and Shamozai; while south of the Swat river the Landakai and Mora ridges separated it from Ranizai, a tract which was taken under the protection of the British Government when the Malakand was occupied in 1895. Adinzai, Shamozai, and Ranizai are names which denote

originally certain sub-sections of the Akozai tribe, but are also applied geographically, as is often the case, to the tracts allotted to the same sub-sections in the original distribution of Yusufzai land.

During his struggles with the Nawab of Dir, Gulshahzada had frequently to face the opposition of recalcitrant Khans in the Swat valley itself, but by 1922 he had completely established his authority over all the Swat Pathan tribesmen. At the northern end of the valley however is a large block of extremely mountainous country occupied by non-Pathan races who are loosely known as Kohistanis. These are probably the descendants of the people who were forced northwards into the mountains when the Yusufzai occupied the lower valleys. They boast an Arab origin but speak a variety of "Dardic" languages. The majority in the Swat valley employ a dialect which is known as Torwali, but the inhabitants of one side-valley use Khilliwal, the language of the Indus Kohistan, while there is at least one village in the extreme north of the main valley which speaks Khowar, the language of Chitral. The Swat Kohistanis had helped some of the Khans of the lower part of the valley in their efforts to curb the Miangul's increasing power. The Miangul therefore, as soon as he was free from anxiety on the Dir side, at once turned his attention to them. Although they are a wild and independent people they possess no cohesion, and he had little difficulty in occupying the whole of their country as far north as Peshmal. Above this at the extreme northern end of the valley is a tract containing valuable forests which is usually referred to as Kalam, though properly speaking this is only the name of a single village. His Highness the Mehtar of Chitral had long laid claim to this tract, and when the Miangul showed signs of occupying it His Highness first sent a peaceful mission to Saidu and then began to mobilize his forces. Government was again forced to intervene, and the Miangul agreed not to interfere in Kalam provided the Mehtar of Chitral and Nawab of Dir similarly refrained from interference. Kalam has thus been left as a sort of no-man's-land in a maze of snow-capped peaks between the three States.

Having dealt with the west and the north the Miangul now turned his attention to the south. Across the mountains which bound the Swat valley in this direction lies Buner, a wide open tract of country drained by the Barandu river. At this time Buner was more or less controlled by a party of Khans with their headquarters at Daggar. As elsewhere in Yusufzai country there were two factions, and sometimes one set of Khans was in power and sometimes another. Early in 1922, while he was still fighting with the Nawab of Dir in Adinzai, the Miangul had been seriously threatened by a tribal force from Buner under the ex-King of Swat, Abdul Jabar Shah. In April 1923 therefore he dispatched his Wazir with a large force and occupied the whole of Buner and the Chamla valley beyond it without a single shot being fired. The method pursued by the Miangul when he had made up his mind to occupy new territory was to make friends with one of the local factions. He would then enter the country in support of that faction, and having half the country already on his side, his forces were usually sufficient completely to overcome the opposite faction. In this case however the Miangul was not left in undisputed possession of his newly acquired territory. The Nawab of Amb, a small State on the Indus, was determined to curb the Miangul's

rapidly growing power and sent a force into Chamla. Some quite severe fighting ensued, but one night the Nawab of Amb's forces suddenly melted away without having suffered any serious reverse. The next year the Miangul advanced still farther and occupied the tracts known as Khudu Khel and Sori Amazai, and began to interfere in Gadun country. Meanwhile the Nawab of Amb had asked Government to intervene, and as it was considered undesirable that fighting should continue between the two rulers, a neutral zone was fixed which included Gadun and Isazai country, and they were both forbidden to interfere in it. By the conquest of Buner, Chamla, and Khudu Khel the Miangul had extended his dominions on the south right up to the border of British administered territory, while to the south-east his further advance was prevented by the neutral zone described above.

North of the eastern portion of Buner and east of the Swat valley lies a stretch of extremely mountainous country intersected by deep ravines running down to the Indus. Most of this is occupied by Akozai tribes who have their headquarters on the left bank of the Swat river. With the occupation of Buner a small portion of this country, called Makhozai, also passed under the Wali's rule and he constructed a fort at a place called Choga. Here he was almost immediately attacked by the tribesmen of the adjoining tracts. He proceeded to beat off the attack, and before the end of the year had occupied the whole of the country down to the Indus, which he was forbidden by Government to cross.

There was now only one direction in which further advance was possible—the north-east, where lies the wild and little-known Indus Kohistan. Here again assistance afforded to rebel Khans gave the Miangul an excuse for action. In 1925 he occupied the Kormang valley, and in 1926 he advanced farther and established posts at Lahor and Besham. In doing this however he encountered unexpectedly heavy opposition and many casualties were sustained. In the winter of 1926–27 the Kohistanis made vigorous efforts to expel his forces from Lahor; they were repulsed after heavy fighting, but no attempt has since been made to penetrate farther into the Indus Kohistan. Beyond Lahor is a great tract of extremely mountainous country comprising the Dubair Seo and Kandia valleys and containing rich forests. It is believed that no European has ever visited it. The inhabitants live in village communities, acknowledge no ruler, and are said to devote most of their time to their local feuds. They speak a tongue which is known as Khilliwal.

In May 1926 Government formally recognized Miangul Gulshahzada as Wali or Ruler of Swat, while he in turn undertook to respect the various boundaries prescribed for his State. In 1933 his eldest son Jahanzeb was similarly acknowledged as his Wali-i-Ahad or Heir Apparent.

I will now endeavour to give a brief geographical description of the new State, and will then say something about the Wali's system of administration and the great progress which the country has made under his beneficent rule.

The boundaries of the State have already been described. In shape it is roughly a rectangle with the Khudu Khel country as an excrescence at the south-eastern corner. Its length from north to south measures about 80 miles, and its width from west to east about 60 miles. Its population is estimated

at about 300,000, and, except in the Kohistani country in the extreme north, consists of Yusufzai Pathans with a large admixture of Saiyids, Mians, and various menial classes, together with a few Hindus.

For purposes of administration the State is divided into four provinces: (1) Swat proper; (2) Buner; (3) the Mandanr country consisting of Chamla, Sori Amazai, and Khudu Khel; (4) the country lying between the eastern watershed of the Swat river and the Indus. Though these divisions are partly racial in character they form a satisfactory basis for the geographical description of the country.

The Swat valley is one of the beauty spots of northern India, rivalling even Kashmir. Fed from numerous sources amongst the snows of the Kohistan the Swat river cleaves its way through forest-clad slopes down to Paiti, where the valley begins to broaden out until it attains a width in places of 3 or 4 miles. The river also grows wider and splits here and there into numerous channels enclosing fertile islands. It is difficult to say whether the valley is more beautiful in the early autumn when the full river winds its way through vivid rice-fields and the hill-slopes are green after the summer rains, or at the beginning of spring, when the more slender stream laces the valley with the deepest blue, and the young wheat and barley crops are full of pink-and-white tulips and blue lilies, and the mustard-fields light up the skirt of the hills with a blaze of yellow, while every turn presents a new vista of snow-clad peaks.

The side valleys too are full of charm. Those on the left bank are mostly short and steep with brooks that hurtle down through a tangle of scrub, past narrow terraced fields and occasional clumps of lofty chinars, while those on the right bank are larger and more open. Two of the latter call for special mention. The first of these is the Harnawai valley, which is upwards of 20 miles long and is the home of two important sections, the Shamizai and Sebujni. It is usually referred to by the inhabitants of the main valley as Bar (Upper) Swat. The Harnawai stream has its sources in mountains 13,000 feet high and supplies sufficient water for extensive cultivation. The second valley, which is known as Nikpi Khel from the section which inhabits it, is an open expanse of undulating country drained by several converging watercourses. Cultivation is largely dependent upon rain, and the people in consequence are not so prone to malaria and are of better physique than the rest of the inhabitants of the Swat valley.

In the Kohistan I have only been on the ground as far as Baranial, but in May 1933 I was privileged to fly over the top of the highest peak, Mankial Tsukai, which is 18,750 feet. The Wali was a passenger in the same flight. The whole country is a maze of peaks and ridges intersected by deep forest-clad valleys.

There are no large towns in Swat. The biggest centre of population is Mingaora, where there is a bazaar which has recently been widened and rebuilt by the Wali. The capital of the State is 2 miles away at Saidu, where the Wali resides and where the tomb of the famous Akhund is situated. A few miles above Saidu, in a little valley running down from Mount Ilam, lies Maina, which the Wali has made his summer residence. The only local industry is the weaving of blankets and the country is almost entirely dependent on agriculture except in the Kohistan, where the forests are an important source

of income. No mineral wealth has been discovered. The average annual rainfall in the lower part of the valley is probably between 20 and 30 inches, about half of which falls between December and May and the rest during the monsoon from July to September. There is practically no monsoon rainfall in the Kohistan, but the abundant snow which falls in the winter feeds the Swat river during the summer months. Wheat is the principal spring crop of the valley, while rice and maize are grown during the hot weather. There is sufficient grazing on the hills for considerable flocks and herds, and *ghee* or clarified butter of very good quality is produced, while wool and hides are also exported.

All the lower hills within easy reach of the river have long been denuded of trees, and even in the Kohistan the more accessible forests have been ruined within the past few generations by indiscriminate felling. With the Wali's consent the surviving forests are now controlled by the Forest Department of the North-West Frontier Province, and it is hoped that it will eventually be possible to reafforest some of the denuded areas.

The Swat valley where it forms part of the State is shut in both on the north and south by high mountain ranges, and is only easily accessible from the Malakand Agency lower down in the same valley. To the north the range that forms the boundary with Dir State nowhere drops below about 8000 feet, while the Karakar Pass, the lowest point in the southern range which separates Swat from Buner, is 4384 feet. The latter range contains the peak of Ilam (9222 feet), a well-wooded cone which forms a very conspicuous feature of the landscape as viewed from the plains of the Peshawar District. On its summit is a Hindu shrine which is visited by numerous pilgrims of that faith at certain seasons of the year, and, as Sir Aurel Stein has shown, the mountain was famous as a sacred site in ancient Buddhist times.

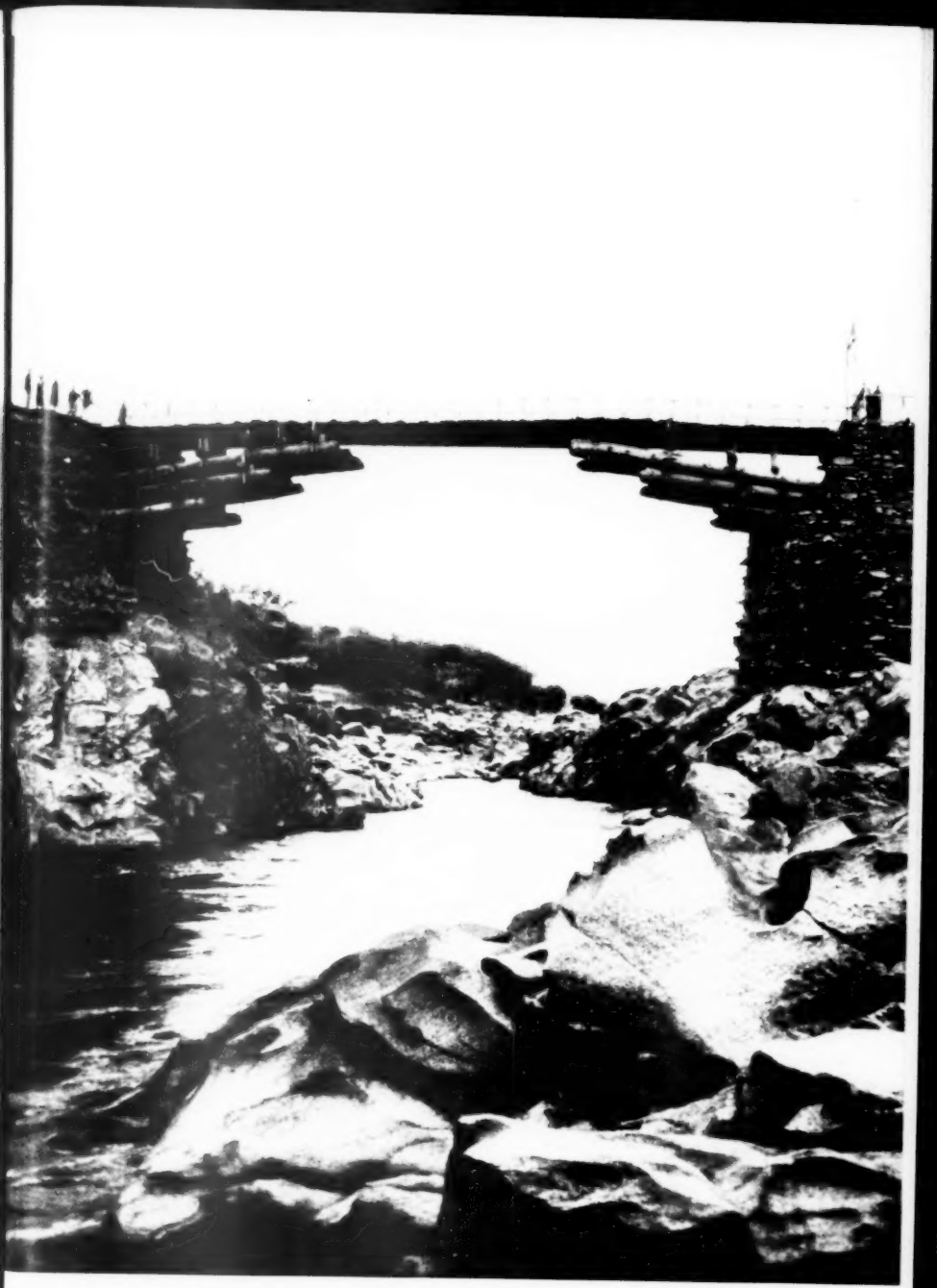
Buner I have viewed from the air and from the tops of the mountains that enclose it on the north and south. It is a wide open plain lying between the range of hills which borders the Peshawar plain on the north and the range which has just been described. Its average elevation is about 2500 feet, and it is studded with sudden peaks and ridges. It has an arid aspect and most of the cultivated land is unirrigated, the chief crop being barley. It slopes towards the east and is drained by the Barandu river direct into the Indus. Three considerable valleys debouch into the plain from the north—Gadaizai, Gokand, and Chagharzai, the first and last of these names being tribal and the second topographical. In Gadaizai is the shrine of Pir Baba, the most famous and frequented place of pilgrimage on the North-West Frontier. As is the case throughout the rest of the State the tribesmen live in village communities, and there are no large centres of population.

I traversed most of the Mandanr country in 1929 when I climbed Mahaban (7379 feet) from Gadun country and descended by the Nagrai valley (Sori Amazai) on the farther side to Chamla, returning to British territory by the Ambela Pass at the head of the Chamla valley. Chamla consists of one long valley averaging a mile or two in width and drained by the Chamla stream which flows into the Barandu a few miles above the latter stream's junction with the Indus. It is more fertile than Buner, and derives its name from the fact that after its acquisition by the Mandanr tribe it was divided up into

chams or plots, one of which was allotted to each Mandanr sub-section except the Amazai, who were separately provided for in Sori and Pitao Amazai. Sori Amazai, meaning Amazai of the Shade, is a narrow well-watered valley running down from the northern slopes of Mahaban and forms part of the Wali's dominions. The best-known place in it is Malka, which was once the stronghold of the Hindustani Fanatics and was destroyed by the tribesmen in the presence of British officers after the Ambela Campaign of 1863. Pitao Amazai, or Amazai of the Sunshine, lies east of Mahaban and is independent, being part of the neutral zone interposed between the Wali and the Nawab of Amb. Mahaban, which means Great Forest, is a well-wooded ridge and is the highest point of the range which skirts the northern edge of the Peshawar plain. Until Sir Aurel Stein visited it in 1904 it was often erroneously identified with Arrian's Aornos. In the foothill country running up to Mahaban from the south-west lies Khudu Khel. This tract extends right down into the plain nearly as far as Swabi itself, and geographically forms part of the Swabi Tahsil. The Sikhs however never succeeded in subduing the Khudu Khel and their country was therefore not included in the Peshawar District when the British took over from the Sikhs. It remained independent until absorbed by the Wali in 1923, and now forms a sort of excrescence to his State, being the only part of it which lies south of the divide between the Peshawar plain and the Barandu drainage area. The country consists of narrow cultivable valleys among the barren foothills and a strip of plain which is irrigated from the Upper Swat Canal.

I have only seen the country lying east of the Swat–Indus divide from the air. It consists of a tangled mass of mountains intersected by three deep and narrow valleys. The mountains rise to heights of 8000 or 9000 feet and fall away in great sweeps and precipices to tortuous ravines, down which silver streams wind their way towards the Indus. This river has here forged a broad course through successive mountain ranges and flows with a strong but not tumultuous stream at an altitude of less than 2000 feet. The slopes of the hills wherever they are not too steep or rocky are terraced for cultivation up to high altitudes, and there is not much forest. There are only a few large villages and most of the population live in scattered dwellings up and down the mountain slopes. The most southerly of the three valleys in this area is drained by a stream which is called on the map the Itai river, though I have never heard this name actually used. This stream has two forks forming two separate tracts called Makhozai and Puran, which have been made by the Wali into one Tahsil, though they are tribally distinct. The lower part of the valley forms a separate Tahsil with its headquarters at Martung. The central valley is called Chakesar and forms one Tahsil. The northern valley has two forks at its western end—Ghorband and Lilauni—and a large tributary farther down on its left bank called Kana. These form three separate Tahsils. The main stream that drains the valley is known as the Sain Khwar. There is one other Tahsil with its headquarters at Besham on the Indus; this consists of the corner of the Indus Kohistan which forms part of the Wali's dominions.

As far as I know, only one European has visited any part of this country on the ground, and that is Sir Aurel Stein, who identified the height of Pirsar



Bridge over the Swat river at Paiti

The Swat valley at Baranial; Mankial Tsukai in the extreme distance

The Darel valley, Swat Kohistan

lying just north of Chakesar with the famous stronghold of Aornos, the capture of which by Alexander the Great is described in so much detail by Arrian. Sir Aurel Stein has given a description of this expedition in the paper to which I have already referred.

Swat proper is controlled directly by the central authorities who reside at the State's capital Saidu. It is divided up into eleven Tahsils, nine of which bear the names of various Akozai sub-sections and coincide with their tribal holdings in the valley. Of the other two Churarai comprises a few villages occupied by Saiyids and a portion of the Kohistan, while the administrative headquarters of the rest of the Kohistan is at Baranial. Buner consists of five Tahsils based on tribal sub-divisions and is administered by a Hakim or Governor residing at Gagra. In Mandanr the three tracts I have described—Chamla, Sori Amazai, and Khudu Khel—each forms a separate Tahsil, and the Governor resides at Totali in the last-named tract. In the country between the Swat valley and the Indus there are, as already noted, seven Tahsils formed on geographical rather than tribal lines. Six of these are under a Governor who resides at Chakesar, while the seventh, Kana, is for special reasons controlled directly by the central authorities at Saidu. Governors of districts administer the Tahsils in which they reside. Other Tahsils are under Tahsildars responsible either to the Governor or directly to the central State authorities, as the case may be.

The whole State is ruled autocratically by the Wali, who is assisted by his eldest son, the Wali-i-Ahad, his Wazir, and his Sipah Salar or Commander-in-Chief. The Wali-i-Ahad is chiefly responsible for financial matters, the Wazir for the political and judicial administration, and the Sipah Salar for the military organization. The Wali is illiterate but decides every matter of importance himself verbally over the telephone. The revenue of the State is derived chiefly from *ushar*, or the tax on grain and other products, and from tolls on imports and exports. The *ushar* is mostly recovered in kind, and State employees are mostly paid in kind. The average annual revenue works out in cash at about twelve lakhs of rupees, say £90,000, a year. The State finances are carefully handled and the expenditure is not allowed to exceed the income. Justice is administered on the lines of tribal custom. Whenever the Wali occupied a new tract he called upon the local elders to put on record their *riwaj* or tribal custom, and this custom is normally followed in all cases of purely local importance. Offences against the State or crimes affecting the public welfare, such as highway robbery, are generally settled by the Wali himself on their merits.

Before the Wali had consolidated his position every tribesman was armed and was under an obligation to turn out for his ruler or tribe in a time of emergency. As soon as he felt himself strong enough the Wali disarmed all his subjects except at one or two points in his State where there is a danger of attack from outside. The more serviceable of the arms he immediately reissued to selected men in each village as State property, thus creating an army of his own to take the place of the old tribal *lashkar*, which lacked all organization and was liable to be fickle in its allegiance. The army is paid in kind and is divided into two separate forces. One mans the numerous forts, with which the countryside is studded, and may be regarded as a sort of

constabulary, while the members of the other live in their villages ready to take the field when necessity arises.

The progress made by the country under the Wali's strong but beneficent rule is marvellous. Peace and order reign even in the most remote and mountainous regions and trade flourishes. At Saidu there is a large school with about five hundred boys, a well-attended hospital, and a veterinary dispensary. There are also schools in many of the outlying districts. Fine residences have been erected at Saidu for the Wali and his eldest son, and several of the leading Khans and Maliks in the villages have built for themselves large tin-roofed bungalows on more or less modern lines.

Amongst other reforms the Wali has abolished the *wesh* or periodical redistribution of land except in the case of the rice-lands in the Swat valley, where constant changes in the stream afford some justification for the system. Formerly in the case of one at least of the Swat tribes whole villages used to change hands every few years.

Perhaps the most notable development is in the matter of roads and telephones. The Wali has fully realized the importance of both of these for tribal control. In Swat there are now about 150 miles of motorable roads. These run along both banks of the main river as far north as Chuarai, and up several of the side valleys. In Buner and Chamla too excellent roads have been constructed between the Tahsil headquarters, but these districts will not be accessible by car until the road over the Karakar Pass has been completed. Much money has already been expended on this road, but in the present financial stringency the Wali cannot find sufficient funds to complete it. In the Indus tracts the country is so mountainous that the expense of making motorable roads would be prohibitive; the Tahsil headquarters however have all been connected by good riding paths. In addition to this the whole of the State is covered by an elaborate telephone system, so that the Wali can at any moment ring up his officials in the remotest parts of his dominions.

How great is the achievement of one man in thus carving out for himself a State amongst the wild frontier hills only those who know the nature of the tribes and the character of their country will be able to appreciate. Miangul Gulshahzada Sir Abdul Wadud, K.B.E., Ruler of Swat, is now in his fifty-first year and is still as strong in body as he is in will. He starts his day at dawn with a constitutional, usually a 1000-foot climb, and is extremely frugal in his habits. He is a first-class shot and spends most of his spare time on *shikar*. He is the most genial of hosts and unsparing in his hospitality, and loves nothing better than sharing his sport with his friends. The Wali-i-Ahad is polished and capable and should in due course prove a worthy successor to his father. Let us hope that the State which Miangul Gulshahzada has founded will continue to prosper and remain for very many years to come a haven of peace on our troubled border.

NOTES ON CURRENT POLAR EXPEDITIONS

J. M. SCOTT

CAPTAIN MIKKELSEN and Dr. Charcot are visiting the East Coast of Greenland this year, and two R.A.F. flying boats are leaving England at the beginning of September to fly by Reykjavik to Angmagssalik. They may go on round the coast to Julianehaab before returning to England by the same route.

There are, besides, three British expeditions already in the Arctic: J. M. Wordie's party, who are visiting Ellesmere Land and the islands of the Canadian Arctic; the British Ellesmere Land Expedition; and Martin Lindsay and his two companions, who are on their way from Disko Bay on the west coast of Greenland to Angmagssalik on the east.

Mr. Wordie's plans are wide and elastic as befits an expedition which uses a ship as its mobile base. He will visit as many places as possible in Ellesmere Land and the Canadian Arctic before he returns to England in September. He has a representative scientific party which is constituted as follows: T. G. Longstaff, medical officer; C. T. Dalgety, ornithologist; Sir John Hanham, botanist; H. P. Hanham, zoologist; P. D. Baird, surveyor; T. T. Paterson, geologist and archaeologist; M. H. W. Ritchie, photographer; and Lieutenant W. E. Fletcher, R.N., who has been lent by the Admiralty to act as surveyor. Mr. Wordie himself is a geologist and is interested, besides, in ice conditions which govern navigation in this area. His ship is the *Heimen* of Tromsö. She is of 129 gross registered tonnage and is propelled by a 160 brake h.p. motor engine. Her captain is Hans Jakobsen, who took H. G. Watkins to Edge Island in 1927 in the old *Heimen*, since lost. She has a crew of ten.

The party sailed from Aberdeen at the end of May. They refuelled at Godhavn, from where they sent an "all well" message on June 8, and then sailed northward along the west Greenland coast. One private message received on July 6 gave their position as Wilcox Head, which is on Holmes Island in the south-east of Melville Bay. But their next message, dated July 24, reported that they had been prevented from arriving at Cape York because the Melville Bay ice was late in opening. This heavy ice persisted, and in a message to *The Times* dated August 1 they described how they had spent the time in climbing mountains on the Greenland coast. Dr. Longstaff and P. D. Baird had made a first ascent of the Devil's Thumb Rock. They had, apparently, given up their intention of reaching Cape York and were going to try to force their way westward across Baffin Bay by the middle passage. On August 15 news of their safe arrival at Eclinton Point in north-east Baffin Land was received in England. These delays must have been extremely disappointing, but they need not be considered serious for the Hudson's Bay ships do not visit their northern posts until the beginning of September. Throughout that month ice conditions among the islands are probably at their best.

The Oxford University Ellesmere Land Expedition is the only one which will winter in the Arctic. It was organized by Edward Shackleton and is led by Dr. Noel Humphreys. Other members of the expedition are Sergeant

Stallworthy of the Canadian Mounted Police; A. W. Moore, biologist and photographer; Robert Bentham, geologist; and David Haig-Thomas, ornithologist. The chief objective is to find a way across the United States range which separates Ellesmere Land from its northern section which is called Grant Land. "The expedition aims," wrote the leader in *The Times*, "at mapping Grant Land and carrying out full meteorological observations with a view to the use of this part of the Arctic as a landing ground for aeroplanes. The northern coast would be the last depot for aeroplanes setting out over the Polar Sea from the cities of Canada and U.S.A." A great deal will depend upon how near the expedition can get by ship to Grant Land, for the narrow strip of sea between Ellesmere Land and north-west Greenland is always more or less icebound.

The *Signalhorn*, a Norwegian sealer of 100 tons gross, sailed from London on July 17. She will call at Disko Island to pick up seventy sledge dogs, and then at Thule to take on board two families of Greenland Eskimos. The *Signalhorn* will then try to force her way as far north as possible along the coast of Ellesmere Land towards Grant Land, before she has to land the Expedition and return to Norway. It is hoped that she may pass through Smith Sound and reach the old Hudson's Bay Company post on Bache Peninsula. It would be ideal, but more than unlikely, that she should reach Fort Conger, for the 150 miles strip of coast between there and Bache Peninsula is comparatively well known. The expedition will spend the autumn in laying depots as far north as possible from their winter quarters. Early next year the main party will sledge north along their line of depots and establish an advanced base on the shores of Lake Hazel, which is between Fort Conger and the United States Range, the boundary of Grant Land.

The district round Lake Hazel was mapped by the MacMillan Expedition, but of the United States Range no more is known than that Greely saw a large glacier cutting through the chain. The party hope to find a route to the unknown country on the other side and then to cross Grant Land to its north or north-west coast. They will return to their main base in May to join the small party which will have been working there during their absence. Together they will cross to Greenland either by sledge or motor boat and travel south to Thule, where a ship will pick them up. If, by some accident, they are prevented from crossing to Greenland they have sufficient supplies to keep them in Ellesmere Land during another winter. They also have wireless equipment, so we should hear from them this autumn the important news about the position of their base.

Martin Lindsay's party was the first to leave England. They are crossing the Greenland ice-cap from west to east with the object of studying from the inside the mountainous strip which extends from Scoresby Sound to Sermilik Fjord behind Angmagssalik. It contains at least one range of something over 10,000 feet. This was first seen by H. G. Watkins and Flight Lieutenant D'Aeth in 1930 when flying in the district of Kangerdlugsuak. Some idea of the extent of the whole mountain chain was gained by A. Stephenson's party when surveying in the district of Mount Forel, and since then Danish expeditions have made an aerial survey of this difficult country.

The only way to examine this district in a single season is to travel by ship to the west coast and sledge across the ice-cap. Lieut. Lindsay's plan was to start his crossing from the north end of Disko Bay and travel along the latitude 70° N. till he reached the mountains at the head of Scoresby Sound. He would then follow a general direction of south by east along the inland edge of the mountainous strip and as close to it as the nature of the ice surface allowed him. He hoped to collect specimens of rock for geological analysis and to fix the altitude of the peaks by vertical angles. He would pay particular attention to the highest range behind Kangerdlugsuak Fjord which H. G. Watkins's party provisionally named the New Mountains. Naturally the amount of time which Lieut. Lindsay's party can spend in this district will depend upon their supply of food and consequently upon the speed which they can maintain. South of the mountainous strip they will find a known exit to the sea in the Base Fjord of the British Arctic Air Route Expedition. In the old hut is a supply of food, and Eskimos can take them in their umiaks or skin boats to Angmagssalik Settlement, which is 30 miles away. There they have arranged to be picked up by a Scottish trawler in September. Thus they will have sledged along two sides of a more or less equilateral triangle, and Martin Lindsay estimated the whole distance as 1000 miles. It is an ambitious programme; but although, as the leader says, there can be no turning back halfway, he possesses a factor of safety in that he can, though at the expense of his work, truncate this triangle of his route if anything goes wrong during the first half of the journey, while he can also save mileage during the second half by travelling far enough from the mountains to allow him to follow a straight course. But from the reports which have been published so far there are no grounds to suppose that his plans will be modified in any such way. Andrew Croft went to Disko Bay last autumn and spent the winter and spring in buying forty-two dogs, training them to haul in three teams, and establishing a depot some 2000 feet above sea-level. Lieuts. Lindsay and Godfrey sailed for Jakobshavn in the early summer of this year. Rough seas and pack-ice delayed them on the voyage and local ice conditions hindered them in reaching their depot. But in their last dispatch dated June 29 they were starting on the sledge journey itself in the best of spirits, thoroughly fit and quite satisfied both with their dogs and their equipment. About the time that these notes are published we should hear of their arrival at Angmagssalik.

In the Antarctic the party at Little America has been engaged in relieving Admiral Byrd from his weather station. The continent will also be visited this year by Lincoln Ellsworth and by John Rymill's British Graham Land Expedition.

An article in the August number of the *Geographical Journal* described how a weather station was established 123 miles south of Little America and how Admiral Byrd flew there at the end of March intending to occupy the station alone during the seven or eight winter months. He had two wireless sets and enough food and literature, and his first messages stated that he was both well and contented. Then, on July 20, he sent a message ordering a tractor to come and fetch him. He had a bad arm, he said, and only his hand-

generated wireless set remained in order. Five men with Dr. Poulter in charge set out by tractor from Little America at once. With the greatest difficulty they managed to travel nearly halfway to the station. There was, of course, no sunlight. They suffered temperatures as low as −71°, and since many of the guiding flags had disappeared they had the utmost difficulty in following the track. Dr. Poulter decided that under these conditions it would be too dangerous to try to cross the badly crevassed area in front; and so they returned to the base.

On July 27 another message was picked up from Admiral Byrd again asking for relief and saying that his receiving set was now out of order. He promised to hang a light on a pole and to fly an illuminated kite to guide the relief party to his hut. Dr. Poulter set out again, this time with only two men and a tractor hauling two months' rations and 472 gallons of petrol, which would mean a load of about 4000 lb. This party was turned back by the breaking of the fan belt when they had travelled only 23 miles. They informed Little America, and returned to find another tractor with its engine running in readiness for the start. Dr. Poulter set out once more and succeeded in reaching the station.

These journeys were at best difficult and hazardous, since they depended upon an internal combustion engine working at low temperatures, and there were numerous crevasses and no sunlight. However immediate anxiety for the safety of Admiral Byrd was removed by the message sent back by the relief party which states that he was thin and weak but safe and in good spirits.

Lincoln Ellsworth is persevering in his attempt to fly across the Antarctic continent from the Weddell Sea to the Ross Sea. It will be remembered that last December he sailed from New Zealand in the *Wyatt Earp* with Bernt Balchen, his pilot, and Sir Hubert Wilkins. They put their aeroplane overboard on to apparently firm barrier ice, but only an hour or two before the flight was scheduled to begin a crack opened under the machine, its undercarriage fell through and was so badly damaged that the expedition had to return to New Zealand and postpone their further departure until this season.

The same party will sail in the Antarctic spring of this year. The *Wyatt Earp* will take them to the coast of Graham Land. In some convenient place the single-engined Lockhead Vega, fitted with floats or skis, will be put over the side. With as little delay as possible Lincoln Ellsworth and Bernt Balchen will take off, fly down the east coast of Graham Land, round the head of the Weddell Sea, and thence direct to Little America in the south-east corner of the Ross Sea. If all is well they will then fly on to New Zealand; if not, Sir Hubert Wilkins will pick them up in the *Wyatt Earp*, but Sir Hubert hopes to be able to use the ship while studying meteorological problems and examining sites for weather stations. The success of this bold enterprise depends upon the smooth and rapid development of the plans. No arrangements have been made to enter territorial waters and the ship will be the only base.

Details of equipment and the general plans of the British Graham Land Expedition were published in the June number of this *Journal*. The preparations for sailing early in September have progressed well, but of the projected work of the expedition we can say little for there is practically no

information of local ice conditions to go on, and the sledge journeys will be made in unexplored country. Besides the eleven members named in the *Journal* for June, the following three additions have been made, bringing the total up to fourteen: Lieut. H. Millett, R.N., Lieut. R. E. D. Ryder, R.N., and Lieut. L. C. D. Ryder, Norfolk Regiment.

Hampton and Stephenson sailed with the sixty-six sledge dogs by cargo boat for the Falkland Islands on July 14. On that voyage the expedition have suffered their most serious set-back. About forty of the beautiful West Greenland huskies have died and many of the others are ill. Their disease has not been diagnosed; in fact the information, which has come by wireless, has been chiefly concerned with numbers dead and alive. Their illness may be due to the heat while crossing the Equator, but more probably it is a form of the dog disease which breaks out in Greenland every few years. Little is known about it, but apparently some microbe which either breeds in the dogs' food or has the power to lie dormant for long periods attacks the brains of the dogs, causes them to run wild and foam at the mouth, and finally brings on paralysis and death. John Rymill has taken the only precautionary measure possible in wiring to Labrador for some thirty-five more dogs, which will be sent out to Montevideo.

Otherwise things have gone well. The *Penola* has been strengthened and refitted, has undergone her trials, and sailed round from Southampton Water to St. Katherine's Dock. She is now being loaded with supplies for three years besides the equipment and the hut. She will sail early in September and call at Montevideo about October 20. Letters to members of the expedition addressed c/o Messrs. McLean and Stapledon, 332 Calle Piedias (Casilla 193), Montevideo, should reach them if posted in England before September 28. The *Penola* will then sail on to Port Stanley, Falkland Islands, and make contact there with R.R.S. *Discovery II*. The dogs will be put on board the *Discovery* and the two ships will sail south together to Deception Island. Before the ice is reached the dogs will be transferred to the *Penola*, which will sail on alone as far as she can down the west coast of Graham Land.

During the first season the work will be chiefly in the form of reconnaissance by motor-boat and by the Fox Moth. A site must be found for the base which may be farther south than the harbour chosen for freezing in the ship. During the next season the coast will be explored to the north as well as farther to the south, and sledge journeys will be made both south and east. It will probably be necessary to extend the work into a third season before the various parties return to the ship and sail north about February 1937.

The wireless equipment of the expedition will be used as little as possible, but dispatches should be received about once a month after the expedition reaches Graham Land. The news will be published in *The Times*. If we cannot forecast the details of the work which will be done we can at least expect a remarkably good ratio of results to money expended. Mr. Rymill has budgeted for only £15,000. This low figure is a record for such an expedition, but it has been arrived at by arranging to use the members of the expedition instead of a professional crew for the *Penola* and by cutting out all unnecessary luxuries. The work of the expedition should suffer nothing in consequence, for the men are young, experienced, and adaptable.

THE PLANCIUS MAP OF ENGLAND, WALES, AND IRELAND, 1592

GORDON MANLEY

A COPY of this map, of which only one other example appears to be known, has been found in Bishop Cosin's Library at Durham. At some time it has been folded and pasted into a copy of the first edition of Stow's Chronicles (1565). Wieder, in his catalogue of Plancius' works, mentions a single copy of the map in existence in a private Dutch collection, giving its date of publication as 1592. It bears the Royal Arms in the top right-hand corner; below is a cartouche, with a brief description in Latin, of England and Ireland, and a note of the characteristics of the inhabitants. At the foot of the cartouche is the engraver's name, Baptista Doeticom, "cum privilegio ad duodecim annorum." The paper shows no trace of a watermark. I am not aware that any further description of the map has been published, and as the possible derivation of the map may be of interest I am adding a brief note.

The size is 55 cm. by 39 cm. Latitudes are added, with equally spaced degrees divided to 2-minute intervals; but not longitudes. A large compass-rose is placed in the mouth of the Bristol Channel and lines of bearing are drawn across the seas from it. Several ships, two fabulous monsters, and a large fish (not a whale) provide additional decoration. The scale is given in greater and smaller English miles, hourly leagues ("Leucae horariae"), and German miles. The smaller English mile is given as 11/12 of the greater mile.

It is interesting to observe that England and Wales, on the map, are exactly the same size as on the first plate of Saxton's atlas of 1579, and that in every other detail inland, so far as England and Wales are concerned, Plancius' map is a very close copy. Even tree-signs are copied exactly in number and position; and the hills and mountains are copied quite faithfully except that if anything they are slightly larger in size. The engraving however is heavier and the map as a whole is not so pleasing to the eye. In view of this exact correspondence in size it is surprising to find that 39 of the greater miles, and $42\frac{1}{2}$ of the lesser, equal 40 of Saxton's miles.

Plancius' map however makes many additions round the coast. In particular, the sandbanks of the Thames Estuary, the Severn, the Wash, and many others are inserted with considerable care, *e.g.* "the Sands of Worms Head" off the Welsh coast. A few coastal names are added to those of Saxton in the south and east, including Orford Ness, "Cantium prom," and the Needles; though the Naze is omitted. Farther west the Eddystone is shown, and the mapping of the Scillies is quite good; with the Wolf Rock and the Seven Stones they are shown more accurately than by either Ortelius, Saxton, or Mercator (1595). An anchorage is indicated in the centre of the group of islands, and they are reasonably placed as regards both distance and bearing from Cornwall. These details suggest that the map was intended to be of use to sailors as well as landsmen. Taken as a whole his mapping here is similar to that of the map of 1590 engraved by Ryther with the illustrations of the Armada battles, and it might be argued that Plancius used Ryther's map for information; but elsewhere along the south coast there are differences. Plancius also differs slightly, both here and elsewhere, from Wagenhaer (1584), and his map appears to deserve credit as the first general map to show

the Scillies reasonably correctly in relation to England and Ireland. The Wolf Rock is named "The gulfe, Belg: De Wolf"; here and elsewhere near the south coasts Dutch or Flemish names are given besides the English names, and for all the estuaries, seas, and islands Latin names are given as well.

The representation of the Isle of Man and the Galloway coast is that chosen by Saxton. A small corner of France and Flanders is different; presumably the detail was taken from the maps of these countries produced by Plancius. The mapping of Ireland presents several problems. The abundant detail is clearly derived from Boazio; in turn his map shows many features in common with the folded map on vellum of about 1572 in the British Museum, formerly attributed to Lawrence Nowell, but thought by Mr. Dunlop to be based on Robert Lythe's survey. Hondius produced a printed copy of Boazio's Ireland in 1591, and a reproduction of it, together with England and Wales, in 1592. It would appear that this map is very similar to that under review, produced by Plancius in the same year. Each differs from Boazio in three significant details: first, the river Derg debouches into the sea in two mouths, at Lough Foyle and "Scheape haven"; secondly, the island of Valentia ("Valentian," Boazio, and Valentia, from an Italian portolan of similar date) is named Baloncian; and thirdly, to the headland west of the Old Head of Kinsale is appended: "7 Castels Where Ye Mahoundes landed." I cannot find any mention of this last in Irish history or in contemporary chronicles; it might refer to a Moorish raid. On the other hand Ortelius' map shows the "O'Maghounde" in Desmond, and the "Clan Mahownd" in Kerry; so that it is quite likely that the inscription refers to a tribal invasion or foray.

These three major points of difference from Boazio suggest that either Plancius copied Hondius or *vice versa*, and that one or both of them had access to a source now unknown. With regard to the island of Valentia, Ortelius has "Balenstijn"; Mercator in 1595 gives "Balencion aliter Valencia." In some other respects however the Plancius and Hondius maps differ; notably in the addition by Hondius of Latin place-names for the more important Roman stations, and tribal names following Camden; indeed, he describes his map as "accommodated to the Britannia." Further, Hondius' placing of the Scillies, and his coastal detail, also differ from those of the Plancius map. It would therefore appear likely that both used the same source for Ireland, and that in other respects Plancius' map represents an independent and careful compilation, making use of inland surveys and, in addition, navigators' charts; some of these last may also have been used by Ryther. It is known that other coastal charts existed at the time (*e.g.* Polter, 1584, of part of the east and south-east coast), and some of these may also have provided material. Plancius is known to have been interested in navigational matters, and his map makes an interesting early example of the combination of coastal and inland detail.

It seems clear, too, that Camden's Britannia was also used by Plancius. This is borne out by the wording of the description of Ireland in the cartouche and by the names, Latin, British, and Irish, given to the sea south of Ireland. An inspection of the series of Camden's letters, published in 1691, does not give any evidence that Plancius was one of his correspondents or known to him; but four editions of the Britannia, including one at Frankfurt (1590), had been published before the issue of the map, and were widely known.

THE SCOPE OF STEREOGRAPHIC SURVEY

LEHRBUCH DER STEREOPHOTOGRAMMETRIE, mit besonderer Berücksichtigung der Geräte der Firma Wild in Heerbrugg. By F. BAESCHLIN and M. ZELLER. Mit 2 Beiträgen von HEINRICH WILD. *Zürich: Orell Füssli* 1934. 10×7 *inches;* viii+516 *pages; illustrations and maps. Fr.*44

THE advent of precise camera construction opened up the possibility of the use of photography as a means of recording precise measurements. When thus used as a supplement to the theodolite, the method of terrestrial photogrammetry was founded. Originally, direct measurements were made on the plates and converted by means of the calibration data into angular values: later, when attempts were made to avoid these computations by providing a mechanical solution, a most effective method was found to be by stereoscopy. If the photographs were taken in pairs, they could be viewed in such a way as to give the impression of a picture in stereoscopic relief. Finally, the aeroplane provided bird's-eye views in place of ground perspectives, and the practical advantages of this in most types of country led to further instrumental development to exploit the new method. A result of these years of research is the automatic plotting machine, which makes use of pairs of photographs in such a way that in conjunction with certain fixed points on the ground the detail and contours of the country may be automatically plotted to form an accurate map. It is with the comprehensive treatment of this advanced technique that this book is concerned.

Most of the literature on photogrammetry has so far appeared in German, and much of it is peculiarly acrimonious. Surveyors however are not noticeably more truculent than other men, and the dissensions of the past have in this case nearly always arisen from lack of clear definition. It is therefore particularly gratifying to find Professor Baeschlin and Dr. Zeller defining in a short introduction the precise scope and limitations of their book. Both have appointments in the University of Zurich, the former as Professor of Geodesy, and the latter as Lecturer in Photogrammetry, and the equipment of the University consists principally of the instruments of Heinrich Wild. They clearly state that it is with these instruments alone that they have a really extensive practical experience, and the book is thus devoted essentially to an exposition of these methods. Professor Baeschlin handles the more theoretical side, and Dr. Zeller rather the practical: the sub-division of responsibility is given more explicitly in the table of contents. Other instruments are described in some detail, but their relatively less complete treatment is not to be taken as an estimate of their value. Valuations in fact tend to be kept in the background.

The *leitmotif* of the book is therefore a comprehensive exposition of the theory and practice of the Wild Autograph, as used either with the Wild Phototheodolite or the Wild Aircraft Cameras. The method of rectification is not dealt with, since there is already a considerable literature on this which is of a less eclectic nature. The description of other instruments and cameras is included in order to give the student a sufficiently broad view to place the Wild instruments in their proper setting without having to refer to other treatises.

It may be said at once that bearing in mind the above limited objective, this book is an outstanding achievement. The general method described is the result of many years' research and practice, and, now pretty well crystallized, it is presented with a scholarship and practical sense that deserve high praise. It would be out of place here to comment at any length on the technical presentation, but certain general reflections may be of interest.

At various stages a paradoxical impression is obtained from the contrast of

the obvious mathematical complications and the repeated claims to simplicity. One wonders whether an innocent simplicity is being embellished by a playful mathematical mind, or whether the solution is not in fact rather complicated. A clue is found towards the end, where a comparison is made between the relative merits of terrestrial and air photogrammetry and the latter found to be far superior, although in Switzerland the conditions for the former are more propitious than anywhere else. A further clue is provided by the enumeration of the very few disadvantages of air photogrammetry, one of which is stated to be the longer time required for setting a pair of photographs. Now, if the problem of *air* survey is treated on its merits, it is possible to design a plotting machine in which the task of setting the photographs is equally simple in the two cases: it has in fact been done both by Fourcade and Ferber. Here is the explanation of the paradox. Terrestrial photogrammetry appeared first on the scene: the Swiss landscape was admirably suited to it: the advent of air photography was treated as merely extending the same technique rather than requiring a new one, and terrestrial photogrammetry exerted over it a hypnotizing and illegitimate sway. This unfortunate genesis has in fact imposed complication on what should be a comparatively simple matter: an involved instrument is the result, though the feeling that it *should* be simple remains. So many weak arguments have been put up in recent years in support of terrestrial photogrammetry that it is refreshing to find its most legitimate supporters reviewing the situation with a healthy doubt.

To what extent the methods that have been so successfully developed in Switzerland are applicable to survey problems in the British Empire is a matter of conjecture, but from every point of view it is unfortunate that this technique is not better known and appreciated. Not only should the possibilities of this kind of method be fully explored, but the way in which they have been exploited in other countries should be respectfully studied. Survey can only be efficiently carried out on a long-term policy, since the proper administration and development of a country is largely dependent on the antecedent production of first-class maps. The Swiss have always realized this. For our own part we now cut down these vital services in the name of economy. Almost everywhere in Central Europe a comprehensive course in photogrammetry is now made an obligatory subject for the ordinary engineering degree, and nearly every Technical High School is equipped with up-to-date apparatus and a highly qualified staff. It is unfortunate that though our need is so much greater, there is nowhere in the Empire where adequate instruction can be received on the subject.

For those used to reading *Reichsdeutsch*, the language in this book may not always be entirely clear, but the German-speaking peoples are to be congratulated on having achieved a high degree of uniformity with regard to technical terms. In a new application of three-dimensional geometry, many words have to be coined, in order to avoid ceaseless paraphrase, or old words given new technical meanings, and, where these apply to movements and the actions associated with those movements, such words should be short and applicable either as substantives or verbs. An authoritative examination and report on this subject is urgently required for English. The available literature in our language is young, but already shows a bewildering variety of terms, while precise translation from German, the most important photogrammetric language to date, is well-nigh impossible.

The production is of the high standard that we expect from Swiss publishers. A useful bibliography refers to one or two English publications, but not to the most considerable work on the subject, Hotine's 'Surveying from Air Photographs,' which contains interesting criticisms of the Wild Autograph, especially when used for air photographs, and should be referred to. J. S. A. SALT

REVIEWS

EUROPE

THE SURREY LANDSCAPE. By GEOFFREY CLARK and W. HARDING THOMPSON. (The County Landscapes.) *London: A. and C. Black* 1934. $7 \times 4\frac{1}{2}$ *inches;* xii + 116 *pages; illustrations and maps.* 5*s*

THE DEVON LANDSCAPE. By W. HARDING THOMPSON and GEOFFREY CLARK. (The County Landscapes.) *London: A. and C. Black* 1934. $7 \times 4\frac{1}{2}$ *inches;* xii + 124 *pages; illustrations and maps.* 5*s*

Of the many who go out into the country in various ways the large majority go for the pleasures of landscape, and there is scope for a series dealing with the counties from this point of view. Of such a series the first is this on Surrey, in the pleasant pages of which the authors treat their subject lightly but adequately. The book has a novel character, and perhaps the best novelty in it is the coloured landscape map, which by distinguishing colours indicates unenclosed country, country of special landscape value, woodlands, river valleys, and characteristic towns and villages, so that the traveller may see at a glance what he may expect on any particular journey. After making a satisfactory analysis of landscape in general as related to geology and sociological history, the book describes the outstanding features of the chalk, sand, and wealden districts of Surrey. In briefly reviewing Surrey buildings, the authors direct attention to "the beauty of form and honesty of purpose evident in our traditional methods" of building. They note that "there is some trait in the psychology of this county which eschews simplicity," adducing buildings rich in design and colour, intricate patterns of tile-hanging, ornate chimneys and multiplicity of gables. They have a half-fearful eye on the possibilities of modern "development." No doubt it is difficult to include all fine viewpoints, but here are three that might be added to a future edition: Over the Weald from Hascombe Camp, northward from Dry Hill Camp, Lingfield, and from the Ellens Green–Cranleigh road towards the Leith Hill range.

The second of the series is equally pleasing and well written. The scenic value of Devon is high, but of a character very different from that of Surrey: Dartmoor, Exmoor, the twofold sea-coast, and the absence of Greater London are the main causes of the difference. The geological map, which indicates thirteen types of surface soil, well explains the exceptional range of types of Devon landscape. "The serene southern estuaries" probably commend themselves to more visitors than the grimness of Dartmoor and Hartland. The detailed descriptions, in the heart of the book, of the varying scene are well done. Of Dartmoor it is well said that its real glory "is the wonderful variety of colour and silhouette in the landscape." It is to be hoped that these two volumes may help in promoting a real understanding of county characteristics, and so prevent further desecration of the countryside by irrelevant building. S. E. W.

EIGHTY MILES AROUND LONDON. By MOYRA FOX-DAVIES. *London: T. Nelson & Sons, Ltd.* [1934]. $6\frac{1}{2} \times 5$ *inches;* 216 *pages;* 100 *illustrations.* 3*s* 6*d*

Although this volume, in the "Shown" series, is apparently intended for children, they are nevertheless assumed to be old enough to back their fancies at Epsom, Ascot, and even Brooklands. They are taken to some four-score different places, to each of which are devoted one page of letterpress and one photograph, though to some, notably to Oxford and Cambridge, a little more space has to be allocated.

The treatment is scrappy and uneven. As Abingdon has a page to itself, the famous town-hall deserves at least a little notice. Similarly the interior of Iffley Church might be touched upon. Canterbury Cathedral is described without mention of its crowning and peculiarly English glory, the central tower; and among the tombs that of Henry IV is ignored. Ely is crammed into one short page. Too much has been attempted, the truth being that 80 miles is far too big a radius for a volume of this size. The photographs on the whole are good, though Winchelsea Church is illustrated by the dullest conceivable view.

Some notice must be taken of the sketch-map inside the cover, roughly on a scale of 25 miles to an inch. Important places like Ramsgate, Hastings, Worthing, do not appear, possibly because they are not mentioned in the text. On the other hand the tiny village of Brookland in Romney Marsh is inserted with a final *s*, and it is to be feared that the draughtsman believed this to be the site of the motor-racing track described and illustrated in the book. But he surpasses himself when he brings Burnham Beeches to the neighbourhood of Maidstone; this feat makes the phenomenon in *Macbeth* seem commonplace. J. H. R.

SOMERSET. By MAXWELL FRASER. *London: Great Western Railway Company* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+166 *pages; illustrations and map.* 1*s*

He who has never loved Somerset let him love her to-morrow—and likewise he who has loved her—by feasting his eyes on the illustrations in this admirable volume which can be his for the modest sum of one shilling. Here are no hack-neyed subjects and viewpoints but most tastefully selected pictures of the lovely scenery and architecture of this shire. Among the latter may be classed the details of the exquisite woodcarving of the West Country churches. We must not start to select our favourites but hasten to add that the letterpress forms a perfectly adequate guide for tourists in search of the picturesque with a dash of history to give a human interest. The author, perhaps excusably, sometimes allows her enthusiasm to run away with her, as when she states that Bath has the finest Roman remains to be found in Europe outside Italy. The epithet "heather-clad" is rapidly becoming inapplicable to Exmoor where the heather is being ousted by coarse tussocky grass which entirely covers large areas especially at the sources of the Exe and the Barle and makes vile going for the pedestrian. J. H. R.

THE ENGLAND I LOVE BEST. By JAMES TURLE. *London: Constable & Co., Ltd.* 1934. $7\frac{1}{2} \times 5$ *inches;* xviii+352 *pages; wood engravings by* EILEEN TURLE. 7*s* 6*d*

For the first hundred pages this looks like being yet another book about Sussex; but the author ultimately drags himself away and follows a devious course, largely by train, through the south-western counties to Land's End. He is a sentimental writer and likes to wander on foot by paths unfrequented apparently by any but aged men who impart to him the lore of the countryside. He lingers especially by little rivers and utters some very serious words of warning about the danger of their pollution not only by sewage but also by chemical discharges from factories. The book is broken up into no fewer than forty-four chapters and thousands of paragraphs, and is a volume to dip into rather than to read through, as some of the mannerisms—notably "A man may . . ."—are liable to become irritating. A misprint may be noted on p. 136, where the scene of the Conqueror's fatal toss should be Mantes, not Nantes. The woodcuts will seem to many too hard and heavy to illustrate the soft and placid scenes of southern England. J. H. R.

LONDON IN 1710, from the Travels of ZACHARIAS CONRAD VON UFFENBACH. Translated and edited by W. H. QUARRELL and MARGARET MARE. *London: Faber and Faber, Ltd.* 1934. 9×6 *inches;* 194 *pages.* 7*s* 6*d*

There is disappointingly little geography in this diary. The worthy Frankfurter was much more interested in old books, coins, scientific instruments, and collections of curios of all kinds than in the buildings and localities where he sought for these things. He had a very poor opinion of the sights of London, and was disgusted at the grime that was allowed to cover everything. The Houses of Parliament are contemptible—even "the Woolsack is very hard to sit on"; but the roof of Westminster Hall gains a grudging word of approval. He frequently attended the play "in order to improve our English, especially the pronunciation," witnessed cockfighting and bullbaiting—"truly English sport," and saw various combats at the Bear Garden. More interesting to many of us to-day is the detailed description of the horse-racing at Epsom, which roused something like enthusiasm in our foreign visitor who found the speed of the horses "really amazing." What would really amaze a modern racegoer was the rule that "a horse must win twice running" and "the racing goes on until a horse has won twice." It is remarkable that many people at Epsom were taking the water which "from its taste must contain a great deal of vitriol."

Other places visited outside London were Hampstead, "the nearest medicinal spring to London" and "an agreeable spot," Richmond and Hampton Court—"with poor old buildings" and a back courtyard built by King William III, "not very large"—and Greenwich where "no royal palace can be more sumptuous" than "the wonderful Hospital for mariners" and where on the top of the hill "Mr. John Flamsteed, the illustrious Astronomer Royal, has his residence and observatory" and "received us with uncommon civility (which is in England most unusual)." The manners of the English appalled and their habits disgusted him. In Middle Temple Hall "the tablecloth looked as if a sow had just had a litter on it."

His desire to behold Queen Anne was gratified one Sunday morning when he saw her walk with great ceremony up the centre aisle of the Chapel [Royal?]; "she still looks tolerably fresh." It is interesting to note that in this year 1710 the great Duke of Marlborough was falling from grace; our German was greatly angered at a soldiers' chorus interposed in a play "heaping public approbrium on so brave a General" though "he has made for himself a most evil reputation through his excessive avarice."

The temptation to go on quoting from this absorbing and amusing diary is great. Of the five months spent in England some ten weeks were occupied in visits to Cambridge—"no better than a village"—and Oxford; but these are only summarized here, and for the latter we already have the volume 'Oxford in 1710,' translated and edited by W. H. and W. J. C. Quarrell (1928), who with the present collaborator have earned our gratitude for giving us a most entertaining work. J. H. R.

POPULATION OF GREAT BRITAIN 1931. A map, in two sheets, on the scale of 1 : 1,000,000. *Southampton: Ordnance Survey Office* 1934. 1*s* 6*d each sheet*

This is the first map of the distribution of population over Great Britain to be produced on an adequate scale; and it will be welcomed by all those who wish to know more of the resources and possibilities of the country.

Density of population is shown by tints of colour from white through browns to black. The densities were calculated for the smallest Local Government unit areas: *i.e.* civil parishes or townships in the rural districts and wards in the urban

districts, with allowance for uninhabited areas such as parks, lakes, woodland, etc. And the boundaries of the resulting areas were somewhat generalized before reduction to the scale of this map. The result is to produce a very vivid picture of the main facts of the distribution of the population, within which a considerable amount of detail can be seen on closer study.

The chief difficulty in the making of such a map is present in a high degree in this country. It is the representation of very great variations of density within a small area. Here there are large parts of the Highlands with less than one person per square mile. At the other end of the scale are densities of more than 76,800 per square mile in "Very Congested" parts of some cities. The range of densities employed requires twelve tints. The densities, and the terms employed to describe them, are as follows:

Description	*Number per Square Mile*	*Number per Acre*
Occasional	0 to 1	0 to 0·002
Very Sparse	1 ,, 25	0·002 ,, 0·04
Sparse	25 ,, 50	0·04 ,, 0·08
Thin Rural	50 ,, 100	0·08 ,, 0·16
Normal Rural	100 ,, 200	0·16 ,, 0·31
Close Rural	200 ,, 400	0·31 ,, 0·625
Transitional	400 ,, 1,600	0·625 ,, 2·5
Semi Urban	1,600 ,, 6,400	2·5 ,, 10
Urban	6,400 ,, 25,000	10 ,, 39
Close Urban	25,000 ,, 64,000	39 ,, 100
Congested	64,000 ,, 76,800	100 ,, 120
Very Congested	76,800 and over	120 and over

This scale is too complicated, and the progression too irregular, to give completely satisfactory results. The descriptive terms are, of course, based solely on conditions in Great Britain; but even there the so-called "rural" densities are pitched too high. Large areas in Eastern England, from Yorkshire to Suffolk, which are wholly rural, are marked from "Very Sparse" to "Thin Rural." Only where there is either specially intensive rural development, as in part of the Fenland, or some outspread of residential settlement from towns or industrial areas, do we get the "Normal Rural" of the map. The "Close Rural" is only very exceptionally rural; it is in most cases found only in mining or industrial or suburban districts. And urban conditions are found where the density reaches only 400 per square mile.

At the other end it is interesting to note that a commonly accepted maximum density for town-planning schemes of one-family houses is twelve houses per acre over built-up areas. This gives somewhat fewer than sixty persons per acre, or 38,400 per square mile, which is within the "Close Urban" of the map. Greater densities are, of course, reached, without any nearer approach to overcrowding, where the housing is in the form of blocks of flats; but such areas are too small to be shown effectively on this scale. The attempt to show the variations of density within the towns fails because the wards are too small area units for the scale of the map; they are hardly visible except in London, Glasgow, and Liverpool. The difficulty is clearly seen by comparing the inset map of London, on the scale of $\frac{1}{4}$-inch to a mile, with the same area shown on the main map. The map would gain by the placing of all the really urban densities into not more than two colours, *e.g.* "urban" from, say, 640 per square mile to 38,400, and "congested" for all above the latter figure. Subdivision of these urban densities could be usefully shown on insets, such as that given for London, for the seven or eight major conturbations. At present the towns do

not stand out very clearly on the map unless there is a considerable area with the density here termed "Congested."

There would also be a gain in the reduction of the number of tints employed and a clearer definition of each. Even when the map is fresh some of these are not too readily distinguishable from each other. When it has been in use for some time they will be less clear. This difficulty could be met by the device, already employed on our geological maps, of using a symbol as well as a colour.

As published the map contains a large number of names. Those of the towns are useful; but most of the rest are irrelevant to the purpose of this map and should be omitted. The county names are wisely left to inset diagrams. And, while it is useful to have the rivers shown, the canals are not needed. On the map before me there is some failure to register. The Scottish part of the map was prepared by Mr. A. C. O'Dell; the rest was compiled in the Ordnance Survey Office. Its completion and publication is due mainly to the initiative and energy of the Director-General, Brigadier H. S. L. Winterbotham, who has thereby done a great service to all concerned in the development of the country. It is to be hoped that such a map will be regularly issued with the Reports of all future censuses, as well as separately. C. B. F.

COMPANION INTO KENT. By DOROTHY GARDINER. *London: Methuen & Co.* 1934. $7\frac{1}{2} \times 5$ *inches;* xiv+352 *pages; illustrations.* 8*s* 6*d*

Of the nine-and-twenty ways of writing about a county the author has chosen a delightful way, linking the present with the past and inviting our forbears to tell us how they felt about their particular corners of Kent. She finely recreates the spirit of places through persons who lived in them, with touches from history, biography, and the poets. Thus we have "Ingoldsby" Barham and David Copperfield at Canterbury, and Elizabeth Carter at Deal, Bryan Faussett digging out Saxon graves at Guilton, and Jane Austen in the yellow room at Godmersham. There is a fanciful and poetical flavour in her prose. Effective short sketches abound, as of Sarre and shipping in the Wantsum or the mumming of the Hooden Horse, of Margate in 1791 or the Deal luggers "hovelling" off the Goodwins, of the discovery of Old Wenderton near Wingham or the "Pisgah-sight" of Romney Marsh from Lymne churchyard. Her pages are alive with new or fresh material culled from unusual sources. One may know his Kent topographically, but will add much to his knowledge and sympathy by a perusal of this, one of the best sort of county books. Minor corrections for a second edition are St. Radegund (p. 11), Maximinus (p. 192), and *haec* (p. 214). The illustrations are excellent photographs reproduced by photogravure in a greenish tint. S. E. W.

L'IRLANDE. By A. RIVOALLAN. (Collection Armand Colin. No. 170.) *Paris: Armand Colin* 1934. $7 \times 4\frac{1}{2}$ *inches;* 202 *pages; maps.* 10.50 *fr*

THE CHARM OF IRELAND. By STEPHEN GWYNN. (Revised and enlarged edition. First published in 1927 in the "Kitbag Travel Books" series, under the title 'Ireland'.) *London: George G. Harrap & Co.* 1934. $8 \times 5\frac{1}{2}$ *inches;* 314 *pages; illustrations and map.* 7*s* 6*d*

Served by the facility characteristic of his countrymen for presenting a wide subject compactly and lucidly, M. Rivoallan covers a great amount of ground in his small volume. After a brief geographical introduction he treats in turn—with enthusiasm which never plunges into overstatement and with constant evidence of wide reading—the history, administration, economics, literature, and art of Ireland. His attitude throughout is that of a good European, an admirer of the Celts, and a citizen of a country linked historically to Ireland. Not unnaturally he occasionally slips over a term or a small point of detail, and

his narrative suffers in places from compression, but, considered as a whole, he deserves congratulation upon his achievement. On some of the wider points at issue, also, such as the possibility of eventual union of North and South, or the constitutional questions which have arisen, he tends to overlook the profounder forces engaged. The present writer however knows of no work in English which can be compared with this.

Mr. Gwynn's book was first published some years ago in the Kitbag series. To this edition he has added a long chapter on recent changes, and on the opportunities offered by Ireland to fishermen. It is a pleasure, after many recent travel books, to read his easy and distinguished prose. As a scholar, politician, and sportsman of wide sympathies he does justice to all points of view, and is the ideal companion for the visitor. A number of illustrations by Irish artists have been added to this edition: the reproductions however are not always entirely satisfactory. G. R. C.

IN AND ABOUT THE MEDITERRANEAN: with Chapters upon Corunna, Oporto, Lisbon, Tangier and Casablanca. By CLIVE HOLLAND. *London: Herbert Jenkins* 1934. $6\frac{1}{2} \times 4$ *inches; 256 pages; illustrations and sketch-map. 5s*

The growing popularity of cruising for a holiday is creating a demand for a guide-book of its own, and Mr. Clive Holland has set himself to provide one for the Mediterranean and the way thither. In his introduction in praise of cruising he gives an idea of what is needed for the voyage, especially for ladies. He takes you by Lisbon, Gibraltar, Algiers, and Tripoli, through the places of most interest in the Mediterranean and up the Adriatic, then by Cyprus and Athens to Constantinople. The book is undistinguished. It gives, as a rule, a description of the entry into the port of call with a brief account of the main points of interest in the town, and Mr. Holland is usually accurate. Doubtless this is enough for the passenger on a cruise with only a few hours at his disposal. His chapter on the Mediterranean as a whole is sound. He is interested in the flora and the climate of the various places of call. The index is very full and will prove proportionately useful. L. C.-M.

ICELAND ADVENTURE: the Double Traverse of Vatnajökull by the Cambridge Expedition. By J. ANGUS BECKETT. *London: H. F. & G. Witherby* 1934. $9 \times 5\frac{1}{2}$ *inches; 198 pages; illustrations and maps. 8s 6d*

This is the account of the Cambridge University Expedition in the summer of 1932. It is written by the Assistant Surveyor: Brian Roberts, the leader, contributing an introduction and appendices which are concerned with food, equipment, and means of travel.

The six men sailed from Hull to Hornafjördur in a trawler with the name of *Lord Balfour of Burleigh* but few other refinements. It is interesting to learn that this small vessel was fitted with echo-sounding gear. With remarkably little delay pony transport was organized and the party set off with local guides to the southern edge of Vatnajökull, the largest ice-cap on the island. Here they suffered their greatest disappointment in the discovery of mechanical defects in the seismograph with which they had intended to measure the thickness of the ice in the line of their crossing from south to north. But even without this instrument the sledge load was well over 100 lb. a man at the beginning of the journey. Added to this they had to contend with the usual obstacles of summer sledging: damp snow and thaw puddles, thinly bridged crevasses, sleet and mist. They spent about a fortnight working in the country to the north of the ice-cap and then returned by much the same route.

In spite of bad weather, limited finances, and the brief time at their disposal

the party seem to have collected much and varied scientific data. That was the result of carefully choosing the personnel with the object that "each member of the party would not be working only for his special subject but was to aim at co-ordinating his observations with those of the rest." The maps reproduced here seem to have been considerably reduced photographically and are therefore too full of details for their scale to be of much use to the reader. But all the results are being published elsewhere. The present book is intended chiefly "to illustrate the lighter side of the expedition—incidents which could never be recorded in the official reports, but which really leave the most lasting impression." One paragraph, chosen more or less at random, will convey the style. "Anderson became very zoologically minded in the evening and set up a fly trap. The bait consisted of a few drops of his precious brandy mixed with a little sugar. The venture was a great success and a serious-looking Anderson solemnly putting intoxicated flies into spirit was a sight to remember. Two rubbers of bridge before turning in reduced the Patriarch's winnings to one-third of a bottle of Malt extract." There may be a bit too much care-free undergraduate spirit for the taste of the average reader, but to the student of travel literature that should be interesting as expressing the modern reaction to adventure which has changed so much even since the days of Scott and Shackleton. This book, too, is a further proof that young men can make books and ingenuity take the place of experience and, where discomfort is a joke, do their work remarkably cheaply. Without the seismograph the expedition cost £500. J. M. S.

THE ITALIAN LAKES AND LAKELAND CITIES. By ARNOLD LUNN. (The Kitbag Travel Books.) *London: George G. Harrap & Co.* 1932. $6\frac{1}{2} \times 4\frac{1}{2}$ *inches;* 156 *pages; illustrations and map.* 5*s*

VENICE: its Story, Architecture and Art. By ARNOLD LUNN. (The Kitbag Travel Books.) *London: George G. Harrap & Co.* 1932. $6\frac{1}{2} \times 4\frac{1}{2}$ *inches;* 158 *pages; illustrations and plan.* 5*s*

Mr. Lunn's book on the Italian lakes covers an unusually wide field, including not merely the lesser lakes, but Milan, Bergamo, Brescia, Vicenza, and Verona, so that it may be said to join hands with his volume on Venice. He is, on the whole, a useful guide to architecture and painting, but he carefully refrains from showing you more than a few of the most important pictures in the galleries. Indeed, one might well complain that the history of Milan, for instance, especially the mediaeval and ecclesiastical history, is treated at disproportionate length in comparison with the actual sight-seeing; and there is certainly too much about the Inquisition, witch-burnings, and kindred matters for a book of this kind. But perhaps it is meant to be read by the intending tourist quite as much as for use on the spot. We are given an amusing description of that notable pirate Medeghino. Lake Maggiore gets rather short shrift, compared with its fellows. Mr. Lunn does not attempt to go off the beaten track. Thus the beautiful walk from the other side of Lake Orta over the hills to Varallo is not mentioned. Lady Mary Wortley Montagu's country villa, with the loggia where she wrote her letters, may still be found at Lovere by the curious, but the accommodation would hardly suit Mr. Lunn, with his taste for the luxury hotel and his apparent preference for the Gardone riviera over the less tourist-ridden portions of Lake Garda. On p. 76 thirteenth century should surely be fourth.

Mr. Lunn's obvious interest in art and architecture makes him a helpful guide to Venice, though he seems to prefer the fashionable Lido as a place of residence to the city itself. He takes you through the most important sights, providing suitable chapters on the history, and architecture, and the art, which he illustrates from the galleries. He is anxious that the tourist in his charge

should not overwork, but assimilate Venice at his leisure. But he deals only with the great periods. Those who find a special charm in the rococo Venice of the eighteenth century, which may surely be drunk in better with the ice or cup of coffee at Florian's he recommends, will not have him with them. He does not even mention the Museo Civico. But perhaps such a taste requires literature as well as art, and Italian literature lies outside Mr. Lunn's sphere, as it probably lies outside the interests of those for whom he writes. L. C.-M.

ASIA

BALI: Enchanted Isle. By HELEN EVA YATES. *London: George Allen and Unwin* 1933. 8×5 *inches;* 188 *pages; illustrations.* 7*s* 6*d*

In a series of short conversational chapters the author sketches some of the characteristic features of native life in Bali and describes her own excursions in a country which obviously delighted her. The book is inexpensive and contains some beautiful photographs, but the ecstatic and ingenuous manner is likely to prove very trying to a reader who seeks anything more than light reading.

C. D. F.

RÉSULTATS SCIENTIFIQUES DU VOYAGE AUX INDES ORIENtales Néerlandaises de LL.AA.RR. le Prince et la Princesse Léopold de Belgique; publiés by V. VAN STRAELEN (Mémoires du Musée Royal d'Histoire Naturelle de Belgique. Hors série.) Volume I. Introduction. By V. VAN STRAELEN. *Bruxelles* 1933. 13×10 *inches;* 222+xci *pages; illustrations*

This monumental work, which is designed to appear in six large volumes, will be a complete record of the scientific results obtained by the expedition led by Prince Leopold of Belgium to study the flora and fauna of the Dutch East Indies in 1929. The volume under review is in the nature of an introduction to the whole work, by Professor V. Van Straelen, the Director of the Royal Museum of Natural History at Brussels, who accompanied the expedition; it contains a general description of Java, Sumatra, Dutch Borneo, the Sunda Islands, the Moluccas, Celebes, the Aru Archipelago, and Dutch New Guinea, which was found to be, for the naturalists, the most interesting of all the islands visited. In the space at his disposal Professor Van Straelen has succeeded in writing a succinct and comprehensive account of each region, with a brief outline of its geographical conditions, natural resources, and inhabitants; but not the least important part of this volume are the photographs which accompany it. The majority were taken by Prince Leopold; some by Princess Astrid. Over one hundred are beautifully reproduced in photogravure, and it would be difficult to surpass the beauty of some of them, particularly the forest scenes. O. R.

AN OFFICIAL GUIDE TO JAPAN: a Handbook for Travellers. *Tokyo: The Japanese Government Railways* 1933. 6½×4 *inches;* ccx+506 *pages; maps and plans.* $5.00

In the case of a country *sui generis*, as Japan is, the production of a reliable guide-book for the use of foreign tourists is no easy task. The compilers of this work, with the resources of a Government Department behind them, have however discharged theirs admirably, and this work is a mine of scholarly information not only on the topography of Japan, but on almost every detail that the tourist could reasonably expect to find in a guide-book. It is moreover an outstanding merit of this work that it should not only contain full information for the traveller who wishes to see the sights of the country and study its life, but should make ample provision for the obstacles that he is likely to encounter, for he is put on his guard against both major and minor vexations: he is, for instance, carefully

shepherded away from trouble by the insertion of italicized warnings against photography in fortified areas, while his attention is drawn to so relatively small a difficulty as that of obtaining Japanese currency if landing in the country during a week-end.

The copious bibliography at the end of the book forms a worthy conclusion to a fine piece of work. E. H. DE B.

PILGRIMAGE TO MECCA. By Lady EVELYN COBBOLD. *London: John Murray* 1934. 8×5½ *inches;* xx+260 *pages; illustrations and sketch-map.* 10*s* 6*d*

Lady Evelyn Cobbold is not the first Englishwoman to visit Mecca. In the winter of 1877–78 John Fryer Keane was in the Holy City, and while there was introduced to a lady called Zaynab. Her English name was Macintosh, and she had been taken prisoner by the rebels at Lucknow twenty years before. She was forcibly married to one of her captors, who subsequently sought refuge in Mecca from the avenging hand of the Indian Government, taking her with him. The poor woman was making her slender living by embroidering skull-caps when Keane met her, for her captor had been dead some years. She was about forty years of age, having been captured as a girl of twenty. There has been at least one other European woman at Mecca: the wife of a German convert who died there five or six years ago.

Lady Evelyn Cobbold (Hajia Zaynab) was favoured in every possible way, but, even so, Arabia is not a country in which a European lady can travel in any sort of comfort, and cutting short her Pilgrimage she hastened away with evident relief, before the expiration of the Days of Flesh-drying. Her narrative is very readable by reason of its tone of sincerity; and the information she imparts seems reliable as far as it goes. It is perhaps inevitable that she should disapprove of Richard Burton; but to say that Burckhardt entered the Haram "disguised" as a Muslim is scarcely more correct than it would be to say that Hajia Zaynab herself was disguised as a Muslima because she discarded her hat and veiled her face while in the Hijaz. Burckhardt lived as a Muslim, and is buried in a Muslim tomb at Cairo.

As far as Mecca and El Medina are concerned, it would be impossible for anybody to enter them without conforming to Muslim religious ordinances. Belief can be left to the conscience of the individual. On the further question of nationality: European travellers with a serious scientific object, even Muslims, will be well advised to adopt disguise. No one who is known to be a European is free from suspicion in the Haramayn. Even the most favoured of European converts is regarded with doubt; even the most innocent; even Lady Evelyn Cobbold (p. 101). Disguise seems more necessary than ever now, since we are told that the King has decided to allow no European Muslim to enter the forbidden precincts until he has spent at least a year in Jidda.

The author is optimistic in her forecast on the subject of slavery. That Ibn Sa'ud has agreed to co-operate with Great Britain in stopping the almost defunct slave trade, by which is meant the importation of fresh slaves into Arabia, means little. Slavery goes on inside Arabia, and it is well known that since the decline in the number imported, greater attention is being paid there to the production of slave children.

Again, how gaily satisfied is the author with the condition of women in Arabia! Apparently she did not learn that in Mecca a girl of the better class is scarcely ever allowed to go outside the harîm quarters of her father's house, from the age of about six until she is married. Even after marriage the only occasions on which a woman is permitted to go beyond the walls of her husband's house

are to attend the birth, marriage, or death ceremonies of relatives, or for a rare visit to the Great Mosque. On such occasions the women are always accompanied by a son or male slave of the master, by whom they are kept under surveillance. In this connection the author quotes copiously from Mr. Marmaduke Pickthall, in an endeavour to display the advantages of Muslim marriage customs over those of the West: ". . . romance is an illusion, and we need never mourn the loss of an illusion . . ." says Mr. Pickthall with sententious superficiality.

When she leaves social matters and turns to the doctrine of Islam the author becomes more reliable, though one or two of her statements seem doubtful or capable of fuller exposition. That the Muslim's "salvation depends entirely" on himself and his actions seems to concede a degree of freewill far beyond that which is left to humanity by many passages of the Koran. In spite of all that commentators have written on the subject, the degree of freewill in Islam remains something of a mystery, as indeed it does in all religions.

The book would appear to have been written mainly as a tract, and in that connection it contains a good deal of information, presented with an enthusiasm which will no doubt compel some attention. The illustrations are good, but some of them are familiar, being among those which were included in another book by permission of General Ibrahim Pasha Rifaat of Cairo, the owner of the copyright. E. R.

AFRICA

THE GREAT TREK. By ERIC ANDERSON WALKER. (The Pioneer Histories. Edited by V. T. HARLOW and J. A. WILLIAMSON.) *London: A. and C. Black* 1934. 9×5½ *inches;* xii+388 *pages; maps.* 15*s*

For some sixty years after the first occupation of the Cape by the Dutch E. I. Company in 1652 the settlement was in the making with people from Holland, France, and Western Germany who, isolated from the rest of the world, amalgamated to form a new nation. For rather more than another sixty years the frontiersmen of this settlement lived with little interference from its Government and with little contact with native races except with imported slaves, with servile Hottentots, and with Bushmen, neither numerous nor aggressive. By the end of this second period the frontiersmen had become a self-reliant, strong-willed pastoral people living on runs of 6000 acres or so and always ready to ride on in their rough, strong ox-wagons, surrounded by herds and flocks, to pastures new. They were of fine physique, led a simple, hard life, eschewed luxuries, and dressed according to bygone European fashions, carrying guns with which they were expert. They had little book learning or knowledge of the world, not much imagination but much religious feeling. In a third period of about sixty years, down to 1834, these men of the frontier, which covered some four-fifths of the whole colony, had come into contact with the Bantus and more under control, or interference, as they would call it, of successive governments of South Africa, Dutch, and English. From this contact and this control and the friction caused by them came the Great Trek in a search for land, labour, and security beyond the limits of the Cape Colony.

It started in small parties and never really came under a single guidance. Louis Trigardt and Janse van Rensburg moved off towards the close of 1835 to what is now the Northern Transvaal, but failed in their attempts at settlement. Early in 1836 Andries Hendrik Potgieter and Sarel Cilliers took possession of the land between the Rivers Vet and Vaal, and in October defeated the Matabele at Vegkop, but had to fall back on another wave of Trekkers which had reached the Blesburg rendezvous under Gerrit Maritz. Here was drafted a constitution for the future state of which Potgieter was to be Commandant and Maritz

leader of the Volks Raad. To them, early in 1837, came Piet Retief, "ablest of the Trek leaders," under whose influence "the Great Trek which had hitherto been an intermittent trickle became something like a stream." He was made Governor of the Trekkers' Maatschappij which he reorganized. Potgieter was left out of the picture. For him the promised land had always been the High Veld and there he proceeded to establish his followers after various delays and a successful nine days' running fight with the Matabele. To Retief the goal of the Trek had long been the Coast Belt, and, overcoming many difficulties, he led his men down the Drakensberg in October 1837. Presently he entered into negotiations with Dingaan, the Zulu King,, who in February of the following year entrapped and massacred him and his immediate party and took heavy toll of his followers, laagered in the Blaukrantz below the mountains. The Trekkers' outlook when Gerrit Maritz died in September 1838 was a gloomy one, but a capital—Pietermaritzburg—had been founded, and in May Port Natal had been occupied. Then, near the end of the year, another leader—Andries Pretorius—defeated the Zulus at the Blood River, though several months elapsed before these "had broken their own military machine and given the Maatschappij security."

While these latter events were happening, a small British force occupied Port Natal, but this had sailed on Christmas Eve, and now for nearly two and a half years the new Republic was to be left pretty well to its own resources and to follow its own ideas. Instructions had been drawn up for working the constitution and progress was made in spite of "the long-continued struggle between the Volksraad Party and the Head Commandant and the Public" which was embittered by personal differences between Pretorius the Commandant and the Volksraad leaders, particularly Stephanus Maritz. The allotment of promised farms and town erfs gave much trouble and little satisfaction, but something was done even here, and, a matter of much greater importance, an attempt was made to unite the coastal and the three High Veld Districts into a single State. In the first half of 1841, the Potchefstroom and Vet River Districts came within the ultimate jurisdiction of the Natal Raad, Transorangia still remaining outside it. An attempt was also made to get a recognition of independence from the British authorities, but this was frustrated by the indignation in the Colony following Trekker interference with the native chief Ncapaai on the south-west Frontier of their Republic. British troops were sent to this Frontier and later, in May, to reoccupy Port Natal. In the meantime other things were going ill; the land problem had been badly tangled alike on the High Veld and in Natal; the policy of segregation of Europeans and natives had broken down; government in all its branches had become "rough and unready"; and poverty, alike public and private, was general. A temporary defeat by Pretorius of the British at Port Natal revived the flagging spirits of the Natalians, but internally things went from bad to worse, and led to the proclamation in August 1843 of British Sovereignty over Natal. The Raad however continued to meet regularly at Pietermaritzburg for two years, and the first British Lieutenant-Governor did not arrive till December of 1845. By that time a second Trek, stimulated by a constitution and by land settlement regulations distasteful to the Trekkers, had begun to empty Natal of those who had settled there in the course of the previous decade; by 1848 most had left for Potchefstroom and the independent Transvaal. In that year British Sovereignty had been proclaimed "over all lands and all men between the Vaal and Orange and the Drakensberg"—the future Orange River Free State. This had led to the fight at Boomplatz in August and to a further exodus across the Vaal which was "the last of the long series of flights from the oncoming 19th century in British uniform that men call the Great Trek."

These are the main points of a story derived mostly from Dutch sources including the diaries of Louis Trigardt, the first Trekker, and of Erasmus Smit, the patient and long-winded preacher, husband to the strong-minded Susannah who was sister to Gerrit Maritz. The story is told without bias, with great descriptive power, and with numerous touches of dry humour. The author succeeds in the intention expressed in his preface and has "made the Trekkers and Governors and missionaries and chieftains and scallywags come to life again." For such a book not only students of South African history but whoever enjoys the picture of a past and different world must rejoice. The reader will forgive the few mistakes which appear in the text, the difficulty he will find here and there of getting the exact sequence of events occurring in different parts, and some inadequacy of illustration. The map which comes at the end of the volume would have been more convenient for reference if it had appeared in duplicate as end papers, and the movements in the various times and of the different branches of the Trek might have been more adequately indicated on separate plans. These are small faults in a great book. M. N.

NORTH AMERICA

THE CALIFORNIA DESERTS: a Visitor's Handbook. By EDMUND C. JAEGER. With chapters by S. STILLMAN BERRY and MALCOLM J. ROGERS. *Stanford University Press, California* (*London: Humphrey Milford*) 1933. $8 \times 5\frac{1}{2}$ *inches;* x + 208 *pages; illustrations and sketch-maps.* $2 (9s)

This is a book written by an enthusiast who thoroughly understands and is in sympathy with his subject, and it is therefore entirely satisfactory, and will be a source of especial interest and pleasure to those fortunate individuals who have spent their years and carried on their work amidst desert surroundings To such readers it bears evidence upon every page of having been compiled by a kindred spirit.

The area covered by the author comprises the north-western extension, within the bounds of the State of California, of the great arid and semi-arid region which extends as far eastward as mid-Texas, and embraces most of the States of New Mexico and Arizona, as well as practically the whole north-western portion of the Republic of Mexico. Conditions of aridity, of high summer temperatures, and of uneven and irregular distribution of the scanty rainfall—all features which combine towards the development of a desert—are treated in detail in the districts described.

Two specialists have contributed chapters which help to round out the descriptions of the biology and anthropology of the desert dwellers; but aside from these points the author has subjected the entire faunal and floral life to such close scrutiny that one feels that few essential details have been missed. The recent geological history, the physiographical and topographical aspects, and the climatic features are reviewed briefly, and the faunal life is then entered upon. The sections treating of the insect and reptilian life are especially interesting. Many examples of adaptation to desert environment, both for procuring sustenance and for protective purposes, are given, and one marvels that life, in some of its apparently more poorly protected forms, can so successfully exist amidst such strenuous conditions. For most of the small desert mammals, and therefore also for the larger carnivora, life begins at sundown and ends soon after sunrise. The author is fully cognizant of this, and has apparently spent many night hours, as have all desert investigators, in watching the smaller creatures venture into the illuminated circle around the camp fire, and the bats and night-flying birds flitting about between him and the stars in search of insects.

Passing on to the botanical features of the desert region under discussion, which he divides for the purposes of ready identification and description into the "Mohave" (more correctly spelled Mojave) and "Colorado" deserts, he states that the two areas support no less than seven hundred species of flowering plants. To those who have seen the desert a-bloom after the brief growing period of the spring rains the estimate does not appear to be at all unreasonable. Twenty-three pages of very good outline drawings to uniform scale of some of the more widely distributed and commonly known varieties will assist even the non-botanical explorer towards identification. Common and local names are given in many instances.

The creosote bush is correctly described as the typical and most truly representative shrub of these Western American desert regions. It extends in distribution from the Sierra Nevada to the region of the Pecos River in Texas and towards the south almost to the Tropic of Cancer. It exists, perhaps, under the most severe climatic handicap in the Mojave and Colorado deserts, and an instance is given in which it was observed to have survived and retained its power of recuperation through a period of thirty-two entirely rainless months in the Mojave area, between 1909 and 1912.

The desert trees, and those also which skirt the truly desert regions, either in the moist flood-plain of the Colorado River or upon the mountain slopes which rim them to the west and north, are given a chapter to themselves. Descriptions of the tree-like yuccas, the imposing native palm (*Washingtonia filifera*), and of the Sahuaro or giant-cactus, are included in this section, although the last named is essentially an Arizonian or Sonoran plant, of which comparatively few specimens exist upon the western side of the Colorado. The invasion, during recent years, of favourable moist locations by the flowering tamarisk, an importation originally from the Mediterranean basin, is also commented upon. The advance of this tree throughout the south-west has been very noticeable during the past three decades, and has doubtless been facilitated by the light and readily wind-borne seeds.

The book concludes with a short chapter upon the technique of desert travel and camping. The development of motor transport and the construction of fine, well-surfaced highways across some of the formerly more inaccessible expanses has robbed the region of most of the difficulties and dangers which used to confront the prospector or "desert-rat" who slowly plodded from water-hole to water-hole behind his patient string of burros and upon occasion left his bones and theirs to mark the place at which the expected water did not exist. The author sums up his advice to those who are willing to investigate the attractions of these great open spaces in one short sentence: "Really to appreciate the desert you must live close to its heart, walk upon its unbroken soil, and camp upon its clean sands." One can hardly conceive of a more pleasant or profitable method of "going back to Nature."

The outline sketch-maps inside the covers, while not very elaborate, are sufficient to give the motor tourist all the special information he needs and cannot readily obtain from the many accurate published road maps of Southern California. G. S.

CENTRAL AND SOUTH AMERICA

BLUE BLAZE. By JANE HARVEY HOULSON. *London: Duckworth* 1934. 9 × 5½ *inches; 288 pages; illustrations and plan.* 12*s* 6*d*

"Would you be ready to do pretty nearly anything?" asked Mr. Mitchell-Hedges of his prospective private secretary. 'Blue Blaze' is the description of one of the journeys that Miss Harvey Houlson made with him some years later. It was the

sort of expedition that carries thousands of rounds of ammunition in its baggage and mixes sport with research, chiefly archaeological. In a small boat they visited some of the islands in the Gulf of Honduras and found relics ranging from Stone Age bowls to "the neck of a bottle evidently of the days of Henry Morgan." During intervals of recuperation they fished for barracuda and harpooned devil-rays. The reader is introduced to a world of great beauty and varied human types. The story is told largely in the form of dialogue, lightly, with touches of romanticism and a genuine sense of enjoyment. J. M. S.

POLAR REGIONS

NORVEGIA RUNDT SYDPOLLANDET: *Norvegia*-Ekspedisjonen, 1930–1931. By GUNNAR ISACHSEN. *Oslo: Gyldendal Norsk Forlag* 1934. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; 252 pages; illustrations and maps. Kr.12 (unbound Kr.9.50)*

Many of the cherished beliefs of polar exploration have been dispelled in recent years. Major Isachsen has banished another in showing that at the age of sixty-two he was not too old for Antarctic adventure. In October 1930 he sailed from Cape Town in the *Norvegia* as leader of Consul L. Christensen's fourth Antarctic exploring voyage. The object was to circumnavigate the Antarctic in the interest both of whaling and oceanographical research. This was accomplished with the help of coal from various whaling ships *en route*. The voyage was not on the whole in a particularly high latitude but was fruitful in oceanographical observations. An echo-sounder was used, but was not satisfactory in high seas, of which the *Norvegia* experienced plenty. It has become a habit for ships in high latitudes to search for mythical islands like Dougherty, Nimrod, and Pagoda Rock, to the list of which the Norwegian whalers have now added Truls Island, reported by the *Truls* in January 1930 in lat. 56° 7′ S., long. 23° 39′ E. None of them was found, and all might safely be erased from the chart. On the other hand, in lat. 65° S., long. 2° 35′ E., a relatively shallow sounding of 656 fathoms revealed the Maud Bank, but time was not available to determine its extent. More than half the book is Major Isachsen's log of the voyage with many interesting observations. An attempt to reach Peter Island was thwarted by heavy pack. Deception Island was visited, but the South Orkneys could not be reached. Major Isachsen returned to Cape Town in the *Thorshavn* from the vicinity of Princess Ragnhild Land and then home in the *Norvegia*. The rest of the book discusses oceanography, whaling, and recent Norwegian additions to the chart of Antarctica. These are shown on a coloured map, already published in the *Geographical Review* (January 1932). There is a conflict in the names given by the Norwegians and by Sir Douglas Mawson to the east of Enderby Land, especially in the use of Lars Christensen Land and Mac-Robertson Land, but that need not be discussed here. The somewhat indefinite and colourless name of Antarctic Archipelago is used for the islands west of Graham Land, the South Shetlands, Palmer Archipelago, and Biscoe Islands. On the other hand the newly adopted and appropriate name of Scotia Sea is not given to the waters between the South Sandwich Islands and Cape Horn. The book is well illustrated, and is a fine record of a notable achievement. R. N. R. B.

DE ØSTGRØNLANDSKE ESKIMOERS HISTORIE. By EJNAR MIKKELSEN. *København: Gyldendal* 1934. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; 202 pages; illustrations and map. Kr.7.50*

The Danish explorer, Captain Ejnar Mikkelsen, who received the Patron's Gold Medal of the Society for 1934, discusses in his last book one of the most interesting problems of the Arctic—that of the fate of the original inhabitants

of East Greenland. All along this coast explorers have found traces of former inhabitants and innumerable tombs, and relics bear witness to an earlier civilization. Only at Angmagssalik, where the first European, Gustav Holm, landed in 1884, was a small tribe of the original population able to survive, and north of this Eskimos have only once been seen. In the Edinburgh *New Philosophical Journal* for July 1830 a short description is to be found of Captain Charles Clavering's historic meeting with twelve Eskimos on the south side of the island which now bears his name: the only occasion on which a European had actually met Eskimos in north-east Greenland. Otherwise nothing but traces had been found of the earlier inhabitants before the colonization of Scoresby Sound.

What then had happened to the natives? Death by famine or poison, by exposure or by the forces of Nature? Captain Mikkelsen cannot be expected to answer these questions fully, but, as a practised explorer, he turns from the mysteries of former times to the possibilities of the future. He concentrates on restoring to the Eskimos their lost territory, and with the establishment of the Scoresby Sound Colony in 1924 he has laid the foundation stone of a new prosperity for the population of East Greenland. It is exactly ten years since the Danish flag was first hoisted over Scoresby Sound, and the intervening years have proved that the settlers were not re-established in these old hunting grounds in vain. On the same coast, where in 1924 we found only crumbled ruins of former human dwellings, the Eskimo hunter has now regained the land of his fathers. Life under the shadow of the Ice-cap has again assumed human colour. Captain Mikkelsen's work for the native population is a fresh manifestation of Denmark's will to open up new possibilities for the Eskimo.

The author describes in detail the work of the last ten years on the east coast and the work of the many scientific expeditions, and discusses the possibilities of a new colony at Kangerdlugsuak, which would be a centre of communication for the nomadic hunters on the 900 kilometres of coast-line between Angmagssalik and Scoresby Sound.

It is seldom that the expert has the power to express himself in terms which are intelligible to the ordinary reader. Captain Mikkelsen, whose charming personality is known to the older and younger generations of British explorers, is particularly gifted in this way. This 'History of the Eskimo in East Greenland' makes both exciting and instructive reading, and in view of the great interest which England has lately shown in Greenland, the book should be sure of an excellent reception, when it is translated into English, as it ought to be. E. M.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

WEATHER: the Nature of Weather Changes from Day to Day. By the Hon. RALPH ABERCROMBY. New edition, revised and largely rewritten, by A. H. R. GOLDIE. *London: Kegan Paul, Trench, Trubner & Co.* 1934. 9×5½ *inches;* xii+274 *pages; illustrations and maps.* 10*s* 6*d*

The publication of Abercromby's 'Weather' in 1887 was a landmark in meteorological literature. It gave the intelligent reader who had no great technical equipment a book in which he found an account of the phenomena of the weather, together with such physical principles as could in those days be applied to unify these phenomena. Until about fifteen years ago Abercromby's treatment of the motion of depressions, and the distribution of weather in these systems, formed the basis of English forecasting. Since 1887 there has been an important change in the meteorological outlook, mainly brought about by the recognition of the phenomena associated with the polar and other fronts. In addition, the exploration of the upper air has revealed the complexity of the

three-dimensional structure of the atmosphere, and has added materially to the amount of observational information now available to the meteorologist.

The time was thus ripe for a revision of Abercromby's treatise, and Mr. Goldie is to be congratulated on the success with which he has carried out this revision. The book has been very largely rewritten, but this has been carried out so completely in the spirit of the original that it is not obvious on a first reading that the book is a revision. In saying this we pay a very sincere tribute to Mr. Goldie. There are new chapters on the upper air and on the structure of depressions, while most of the other chapters have been brought up to date. A very clear account is given of the controlling effects of temperature, the relation of wind to pressure gradient, and of special phenomena such as thunderstorms and line-squalls. The treatment is nowhere excessively technical, and the book should be particularly suitable for students of geography who wish to read an up-to-date account of meteorology.

The present reviewer does not accept in its entirety Mr. Goldie's account of "frontal" phenomena in depressions. In discussing the occlusion of a depression, the author states that "the warm sector is gradually surrounded and finally lifted off the ground." This statement is not borne out in practice; the occlusion starts at the centre and works outward. Some of the original diagrams of J. Bjerknes and H. Solberg reproduced in the book represent the depression as forming at the boundary separating a cold easterly current from a warmer westerly current flowing south of it. In many of the depressions which form over the North Atlantic and drift across North-Western Europe east winds only appear at a late stage of the development. These depressions form at a boundary between two westerly currents of different origin.

The criticisms made above refer to a few pages only of the book, and can in any case be readily rectified in a new edition. Mr. Goldie has produced a book which will meet the needs of a very wide public. It can be recommended as the best account of the present position of meteorology for the student who does not wish to enter into the mathematical treatment of the problems of atmospheric physics. And the professional meteorologist will find the book a useful addition to his library. D. B.

OCEAN WAVES, and kindred Geophysical Phenomena. By VAUGHAN CORNISH. Additional Notes by HAROLD JEFFREYS. *Cambridge: University Press* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xvi+164 *pages; illustrations.* 10*s*

Though the title of this book is 'Ocean Waves,' a third of it is devoted to river waves and to waves in snow and sand. Dr. Cornish has collected in it the results of a series of observations extending over a period of nearly forty years. They were made in part with the purpose of providing numerical data for the use of mathematicians, and it is a matter for congratulation that Dr. Harold Jeffreys has written an appendix giving a short description of the modern wave theory, which differs from the classical theory in that it takes account of friction and turbulence. But, as he shows, the classical theory serves to explain many of the phenomena of the deep-sea wave, the length of which is small in comparison with the depth of the water. There is a theoretical ratio between the length, speed, and period of such a wave, and Dr. Cornish was long puzzled by the fact that the estimated length was often shorter than that calculated from the period. He now shows that the estimated length tends to be too small because the attention is held by the steep shoulders rather than by the flat crests of the larger waves. The book contains many similar valuable hints on observation, and a table of empirical ratios between the speed of the wind and the maximum dimensions of fully developed waves. According to this the speed of a wave is

four-fifths of the speed of the wind, and its height in feet is equal to the speed of the wind in statute miles per hour multiplied by seven-tenths. The fetch must of course be sufficient; a moderate gale would develop on Lake Superior a wave of only half the height that it would have if in the open Atlantic Ocean.

The author, well known as an authority on the bore in the Trent and Severn, points out that a much larger number of simultaneous observations is still needed for the proper discussion of the problems, and suggests that a party of undergraduates could spend an enjoyable fortnight in September in investigating them.

A section is given to waves in sand and snow, which are not waves at all in the true sense of the word and obey quite other laws. The theory of the formation of such waves is still far from complete, but there appear to be two requirements. In the first place there must be some slight irregularity, such as the wind can set up with ease in the smoothest sand surface, and the current must be strong enough to lift the grains. Fine gravel may be blown along, but unless it is lifted waves are not formed. When mixed with sand however it tends to collect in the crests of the ridges and aid their development.

The photographs are of unequal merit and some appear to have been printed from worn blocks. But this is only a detail, and any one who wishes to take up the study of waves will find an excellent introduction in this book. D. J. M.

CARTOGRAPHY

SATELLITE STATION TABLES. By C. M. L. Scott. *London: Edward Arnold* 1934. 11 × 8½ *inches;* viii + 44 *pages; diagrams.* 12*s* 6*d*

These tables for the Reduction to Centre of angles observed at a Satellite Station will prove most useful to surveyors doing trigonometrical work, especially in cities and towns, where such stations are a necessity. In the past it has been the habit of surveyors to avoid the use of Satellite Stations on account of the labour involved in the computations, and on account of the fear that inaccuracies of unknown dimensions might be introduced thereby. These tables will free the surveyor from the necessity of calculation and from the fear of inaccuracies, and will expedite his work. The explanation attached to the tables is excellent in its method and in its simplicity, and if the four rules which the author has deduced from theoretical considerations are followed, no chance of error or blunder should arise in the determinations of reduction to centre.

The graphical method in Appendix I will be welcomed by those who are engaged on tertiary triangulation. This method will also provide an independent check on the results of any determination by the tables. The subsidiary uses to which the tables may be put are well explained in Appendix II, and there is only one case which might have been referred to, namely, the case which occurs frequently in rough country where a lone tree is left standing and a beacon is erected over the station of observation nearby. This beacon is observed from other stations at which the tree is not visible, and when it is decided whether all reductions should be made to the tree or the beacon, it will be necessary to apply corrections to the angles observed at such other stations. These corrections can readily be obtained from the tables and their signs are easily determined. W. M. G.

ECONOMIC AND HISTORICAL GEOGRAPHY

AN ATLAS OF CURRENT AFFAIRS. By J. F. Horrabin. *London: Victor Gollancz* 1934. 7½ × 5 *inches;* 168 *pages; maps.* 3*s* 6*d*

This small book is a praiseworthy attempt to assist the general reader to a better understanding of current world problems. It contains seventy-four sketch-

maps in black and white, each faced by a page of explanatory text, which display clearly the interaction of geographical and political features. Similar sketches are characteristic of foreign, particularly German, studies on "geopolitics," but this collection is so far unique in this country. A practice which may mislead is that of shading land over a certain height and referring to it as "mountains"; but on the whole, within their limited scope, the sketch-maps are successful. There are one or two errors in the text: Tangier is said to be a Spanish protectorate; the date of the British acquisition of the Suez Canal shares is erroneous; and the statement that the internal divisions of Spain are consequent upon river valleys separated by high mountain barriers is contradicted by the accompanying map. One or two maps showing the world relations of the Powers would have rounded off the survey. This book however should certainly be added to all school geographical libraries. G. R. C.

L'HOMME ET LA MONTAGNE. By JULES BLACHE. (Géographie Humaine. Collection dirigée par P. DEFFONTAINES.) *Paris: Gallimard* 1933. $9 \times 5\frac{1}{2}$ *inches;* 190 *pages; illustrations.* 30 *fr*

It is characteristic of the French geographers that they have much skill in combining personal observations and general reflections in an interesting and suggestive fashion, and M. Deffontaines is exploiting this capacity by developing a series in which the volume under review is the third. The first, by G. Hardy, dealt with Geography and Colonization; the second, by the editor of the series, discussed Man and the Forest; and M. Blache, on the basis mainly of his intimate knowledge of the French Alps, writes on Man and the Mountains. There is no suggestion that Mountain Life calls forth definite and universal human reactions; rather we are led to see in what varied ways mountains and man influence one another. The typical solutions of the adaptational problem in the Alps show poverty of cultivation but complex development of pastoralism and of seasonal and other movements of population. The typical oriental solution is one in which the mountain remains wild, often the refuge of backward folk hostile to the more advanced life of the plains. In Africa and native America, on the other hand, the mountaineers have often been on a higher cultural level than the people of the lower lands. But within these great classes the variants are innumerable and the author tries to picture them for us in a few vital phrases. It is the inevitable weakness of such a book that it rarely satisfies one completely about any region one knows personally, and it would be possible to suggest important additions to, and adjustments of perspective in, the accounts of mountain life in Britain. But the stimulus to thought runs through every page and the interest of the reader is most ably maintained. The illustrations, mostly photographs of scenery and establishments among the mountains, add very greatly to the value of the book.

Some will have doubts about the author's view that pastoralism preceded the development of agriculture in Mediterranean lands; pastoralism was however undoubtedly important there at an early stage. A contrast is drawn between Alpine and Scandinavian mountain life arising from the fact that high areas, which to the former give summer pasture, to the latter oppose peat-bogs. It is an interesting reflection that this state of affairs in north-west Europe may date only from the establishment of the present "sub-Atlantic" climate some centuries before our era.

Perhaps one of the most important subjects treated is that of demography: the seasonal migration of shepherds to the mountain, of agricultural labourers and others down to the plains; the emigration of men and women to unskilled labour and domestic service in the lowlands usually with aspirations to return

with money saved to buy some land; the almost enforced emigration of surplus inhabitants once the limit of population is reached; the lure of cities drawing people away from mountain homes in regions where cities are old and rich, but hardly at all where the mountain peasant life has a strong tradition, and cities are relatively less important, as among the Balkan and Carpathian mountains.

H. J. F.

GENERAL

ADAM'S ANCESTORS. By L. S. B. LEAKEY. *London: Methuen & Co.* 1934. $7\frac{1}{2} \times 5$ *inches;* xx+244 *pages; illustrations.* 7*s* 6*d*

Dr. Leakey's magnificent work in East Africa is well known to all Fellows of this Society. His field work has covered a wide range of the sciences and has done much to forward our knowledge of early man. In this book he tells us a little of his own history and work in Africa, but for the most part he is concerned first with the archaeology of early man in general and secondly with his physical characteristics. The book is essentially popular and in such circumstances it is of course impossible in many cases to go into details or to give reasons for judgments. The exposition of the archaeological aspect of the problem is clear and should be easily understood by the layman. The anatomical part is less lucid. We have grown so accustomed to the skilful pen of Sir Arthur Keith as an exponent of these technical problems that other writers are at a disadvantage, but the present reviewer feels that in this part Dr. Leakey has not always succeeded in making his points clear in a matter which is naturally extremely difficult to demonstrate in cold print. Maps, especially in a popular book, would have been very welcome; otherwise the illustrations are well chosen and clear, though the prints from which the half-tones were made might with advantage in some cases have been lighter.

L. H. D. B.

THE DIABOLICAL: . . . a Journey from Palestine to England across Asia Minor and the Balkans. By H. H. MCWILLIAMS. *London: Duckworth* 1934. $9 \times 5\frac{1}{2}$ *inches;* 312 *pages; illustrations and sketch-maps.* 12*s* 6*d*

This is an account of an enterprising journey to England from the archaeological site of Tel Duweir in Southern Palestine made in the expedition's Ford lorry, converted for the purpose, by five of its members. Their adventures on good roads and bad, chiefly the latter, through Palestine, Syria, Turkey, and the Balkans, and their experiences as novices at motor caravanning in these countries are entertainingly described. In common, though, with nearly all those who have tried to recount the details of a long motor journey, the author suffers from having to drive fast. An average of 13 miles per page is hard to keep up.

By including the difficulties encountered and the mistakes made, both mechanical and otherwise, Mr. McWilliams has succeeded in weaving into his story without too much labour many hints useful to those who may attempt a similar journey. Further information is given in the appendix. The route taken is shown on two maps, which give the sections of it which were found to be good and bad. This information would have been of more value if the year in which the journey took place were mentioned.

The book is well illustrated with photographs, and, better still, with excellent sketches made by the author.

R. A. B.

THE MONTHLY RECORD

THE LOAM-TERRAINS OF SOUTH-EAST ENGLAND

Antiquity for September 1933 contains an article by Messrs. S. W. Wooldridge and D. L. Linton entitled "The Loam-Terrains of South-East England and their relation to Early History." Its purpose is to supplement the presentation of population and settlement in Dr. Cyril Fox's valuable work on 'The Personality of Britain.'

Dr. Fox draws a fundamental distinction between the porous soils derived from chalk, sand, and gravel which in early times were "areas of primary settlement," and heavy clay soils which were "areas of secondary settlement." But Wooldridge and Linton emphasize the importance of recognizing in that portion of England lying within the main chalk escarpment a third soil-type of an intermediate loamy character presenting optimum conditions for cultivation and settlement. This type, covering considerable areas in Kent and East Anglia, is derived from a number of parent materials: high- and low-level brickearths, terrace gravels, calcareous boulder clay, Thanet marls, Lower Chalk, Upper Greensand, Sandgate, and Hythe Beds. The loams are described as in many ways analogous to continental loess.

The authors proceed to show on archaeological evidence that in the Bronze Age such highly porous soils as the sandy Bagshot plateau were as little sought for settlement as the heavily forested London or Wealden Clays, and that it was the loam-terrains which were in reality the "areas of primary settlement." These, first entered upon in the Bronze Age, were extensively occupied in the Belgic phase of late Iron Age times, inherited with but little variation by the Romans, and finally consolidated and extended as regional nuclei by the Nordic invaders before they moved to the areas of heavy clay. To-day the loams remain areas of high agricultural value.

It is maintained that if independent status is given to the soil-group in question the study of the progress of early settlement is considerably clarified, and the meaning of the term "valleyward movement" is also rendered clearer. In south-east England it was to plains and low plateaux of a definite soil constitution as well as to valley floors that early man progressively moved.

DEFORESTATION OF FRENCH ALPS

The part played by herds and flocks in the destruction of trees and vegetation in the French Alps has been the subject of some controversy. Mons. Lenoble, pointing out that the number of animals increased steadily between 1789 and 1914, has assumed that the same progress was taking place earlier, so that the numbers in the Middle Ages must have been comparatively small, and their effect upon the mountain vegetation negligible. Mlle. Sclafert, in the *Annales de Géographie* (March 1934), brings together much documentary evidence to controvert this view. An inquest of 1471 for the revision of taxation in Haute Provence gives detailed figures for the total of sheep and smaller animals kept in the Verdon, Var, and other valleys. In one community there was an average of 223 head for each house. Sheep appear to have been plentiful in other valleys not included in this inquest: Thorame, for example, had approximately 6500 in 1520. The figures for goats are less definite, but as early as 1363 their ravages were causing alarm, as they were three hundred years later.

Cattle raising on a large scale was also practised. In addition to permanent stock, animals were bought in Dauphiné, fattened upon the mountain pastures, and sold in the markets of Avignon, Aix, and elsewhere. The ravages of troops

of animals belonging to nobles who were not resident in the valleys were frequently the cause of popular complaint. During the summer the animals were driven up to the meadows and woods on the rough slopes of the mountains which were held in common by the communes, with practically unlimited rights. Often several common pasturages would be joined together, and the herds increased to unmanageable sizes, especially in the Verdon valley. The rights also permitted in winter the collection of fuel, of leaves and branches for feeding the stock (this probably involved the actual felling of the trees), and of bushes for litter. Mlle. Sclafert has certainly advanced evidence for considerable deforestation, and, what is perhaps of more general interest, for a flourishing pastoral industry very different from that which the present condition of the valleys suggests.

LOCAL CLIMATE IN AUSTRIAN ALPS

Dr. Wilhelm Schmidt, Director of the Central Meteorological Institute, Vienna, contributes to the *Quarterly Journal of the Royal Meteorological Society* for July 1934 a valuable article on "Observations on Local Climatology in Austrian Mountains," being an abstract of a lecture delivered before the Society on 28 March 1934.

The observations are in connection with the work of the Lunz Biological Station which is situated about 2000 feet above sea-level and 150 miles south-west of Vienna on the border of the higher Alps. On a plateau to the south of Lunz, covering an area of some 20 square miles, dissected by deep narrow valleys with summits reaching a height of 6000 feet, there have been set up a considerable number of bioclimatic stations whose sites were selected for the study of the effect of local configuration on climatic conditions and vegetation. As a rule the steep slopes of the valleys in this area are covered by conifers, chiefly pines, but in a belt between the altitudes of 2000 and 3000 feet deciduous trees, chiefly beech, occur, to give place still higher up to pines again which become progressively stunted. Since the soil and subsoil are nearly everywhere the same in this experimental area the differences in vegetation must be the result of climate.

An extraordinary contrast is shown in certain types of weather between one station known as Höherstein situated at the top of a cliff protruding into a valley and another, Gstettneralm, at the same height above sea-level (1250 metres), situated at the bottom of a hollow 150 metres deep, where very low temperatures are liable to occur. Thus during the week 18–25 January 1930 the temperature at Höherstein hardly fell below the freezing-point and rose every day to between 45° and 50° F.; but at Gstettneralm, only half a mile away, the temperature even at noon hardly rose above freezing and fell nightly to the vicinity of −15° F. On the morning of 31 March 1931, after a night of intense radiation from a deep snow-cover the temperature at the bottom of the Gstettneralm depression was as low as −48·4° F., but at the top, some 500 feet above, the reading recorded was no lower than −4·7° F.

The frequent, very steep inversions of temperature characteristic of the hollow or "doline" in question are reflected in the vegetation, for whereas at the bottom no trees can withstand the excessively low winter minima, in spite of the shelter from wind, on the slopes there is a gradual sequence from dwarf pines to taller trees. The mountain sorrel, which at the other stations has a vegetative period of several months, does not at Gstettneralm come out of the ground before the end of May, is in full bloom about the middle of June, and sheds its seeds a month later. The short season of growth is caused by the liability to sharp night frosts as early as August. The organs in the soil however are protected from the winter cold by the thick layer of snow, so that even when the surface temperature

is at −50° F. the soil temperature at a depth of 5 centimetres will be only a few degrees below freezing-point.

The lowest part of the rim of the Gstettneralm doline is only 50 metres above the bottom, and on cold nights the air is described as flowing over the edge from the pond of cold air like water over a weir. Dr. Schmidt thinks it possible that the absolute minima recorded at Gstettneralm are the lowest in Europe, excluding the extreme north-east part of the continent.

With reference to the highly localized conditions in mountainous areas Dr. Schmidt makes use of the term "micro-climatology"; but it was suggested in the discussion which followed his lecture that all climatology should be regarded in this light, since the large-scale representation so familiar in charts and text-books are but approximations to the facts of distribution even in flat country.

STUDIES IN JAPANESE GEOGRAPHY

The *Geographical Review* for July 1934 contains four articles on the Japanese Empire, three of which deal with the distribution of population. The stages in the settlement of Hokkaido are analysed by D. H. Davis, and related to agricultural and railway development. The types of settlement range from the cleared and closely cultivated Ishikari plain near Sapporo to the pioneer clearings around Shari in the north-east. Special, rapidly maturing varieties of rice have been introduced, so that, though the topography does not favour rice cultivation, it is the most important cereal crop. In the newer areas the crop is buck-wheat. Owing to the type of agriculture and the influence of American advisers, the country has a superficial resemblance to similar topographic areas in the United States. The population in 1869 numbered 58,000: after more than fifty years of immigration from the southern islands it was (1903) over 2·8 millions, and in its structure is characteristic of a pioneer area. Immigration is now falling off, because of the natural increase in population, and the inability of the agricultural land to support densities at all comparable with those of the southern islands. The Government hopes eventually to maintain a population of six millions.

The paper by G. T. Trewartha on Japanese cities emphasizes the concentration of population in the sub-tropical humid regions south of 37° N. In this belt are found 86 of the 107 cities with more than 25,000 inhabitants: the northern part of Honshu has 15, and Hokkaido only 6. Apart from the climate, this concentration is due to historical reasons, and to the attraction of good communications by sea, for most of the great cities are placed upon flattish coastal plains. The medium-sized Japanese cities have several characteristics in common, especially the rectangular street grid, partly of Chinese origin, in distinction to the six great cities.

Another article by J. W. Coulter and B. B. H. Kim presents dot maps of the population and agricultural products of Korea, another field for Japan's emigrants. As might be expected there is a close relation between the distribution of population and the rice-producing areas. Of late years, under Japanese stimulus, the fishing industry has progressed considerably. The number of Japanese in Korea is at present about half a million, out of a total of twenty-one millions. Finally, there is a useful physiographic diagram of Japan by G. H. Smith.

THE LIVINGSTONE TREE FROM OLD CHITAMBOS

A principal object in the Museum of the Society is a section of the tree under which Livingstone's heart was buried by his native followers, and which has

always been referred to as a Mpundu tree. A recent inquiry from Lord Powerscourt led us to inquire what was the evidence for this attribution, and by the kindness of the Director and Assistant Director of the Royal Botanic Gardens, Kew, we are now able to place the following on record:

1. The botanical name of the Mpundu tree is *Parinari mobola* Oliver, and it is a member of the Rosaceae. It was formerly known as *Parinarium mobola*.

2. A small shaving of the tree has been examined at Kew, and the Director writes: "I think there is little doubt that it is a species of *Parinari* (*Parinarium*). However, it differs in certain respects from an authentic wood specimen of *P. mobola* brought back from Rhodesia by Milne-Redhead (Milne-Redhead 990). It has also been compared with *P. excelsa* (Milne-Redhead 992) and *Parinari* sp. (Milne-Redhead 993). Of these the Livingstone specimen most strongly resembles *Parinari* sp. (Milne-Redhead 993), but it is doubtful whether it is the same species."

3. With the tree the Society has had for many years some leaves, evidently of two distinct species, labelled "Leaves of the Livingstone tree." The Assistant Director has examined these and reports: "The smaller leaves belong to species of *Parinari* and most probably *P. mobola* Oliver. The three large leaves in the middle of the mount are those of a different plant, *Syzygium guineense*, which is only a small shrub or tree. It is probable that these leaves were picked up beneath the Mpundu tree."

HEAVY RAINS IN GEORGIA

The heated waters of the Gulf of Mexico and adjacent parts of the Atlantic Ocean impart to the air over the south-eastern United States a high vapour pressure that results from time to time in very copious rainfall. For the state of Georgia statistics of heavy rains are given in the *Monthly Weather Review* for October 1933 by G. W. Mindling, followed by an account by A. H. Scott of the meteorological conditions favourable to them.

It is shown that for 15 stations scattered over Georgia, most of which have a mean annual rainfall well under 30 inches, the percentage of occasions during the 20 years 1911–1930, when the amount of rain recorded in 24 hours (from midnight to midnight) amounted to an inch or more, was nearly 50, an extraordinarily high proportion of heavy rain. Long spells of heavy rain for several days giving rise to serious floods are also fairly common. Intense rainfall amounting to 10 inches or more in 24 hours has been recorded on eight occasions, and in respect of these Georgia is surpassed only by Alabama, Florida, Louisiana, and Texas. The greatest 24-hour rainfall on record in Georgia is 18 inches at St. George on 28–29 August 1911. This record has been surpassed three times in Texas, twice in Louisiana, and once each in Alabama, Florida, and North Carolina. By contrast, as much rainfall as 10 inches in 24 hours has never been recorded in several Northern States, and in some of the Rocky Mountain States not even as much as 5 inches.

Really heavy rains (5 inches or more in 24 hours) occur most frequently in Georgia between July and October either as a result of thunderstorms or of tropical cyclones, but they are also quite frequent in February and March when extra-tropical cyclones pass over or near Georgia. The production of heavy or excessive rainfall in the colder months of the year however is less easy than in summer, and in practically every instance has been associated with high pressure immediately to the east or north-east of a trough of low pressure over the state, an arrangement which causes a vigorous inflow of warm humid air from the south.

GEOGRAPHICAL RESEARCH IN THE UNITED STATES

From time to time discussion arises over the methods of geographical research and the need for a systematic technical vocabulary. At a recent meeting of the Association of American Geographers three papers with the general heading "Conventionalizing Geographic Investigation and Presentation" were read and discussed. It is not proposed to summarize them here, but the general tendencies may be commented upon. P. E. James, in the 'Terminology of Regional Description,' objected to the antithesis between "man" and "nature," and thus to the term "natural, or geographic, environment," since the "human elements are no less geographic than the non-human elements." He therefore proposed to use the term "fundament" for the face of the particular area before the advent of man, and "occupance" for the process and results of man's life in the area. It will seem to some too sweeping to regard the human elements as strictly geographical: the writer however later shows himself as desirous of insisting upon the methods rather than the objective of geography.

In discussing the technique of studies of distributions he remarks upon their tendency to become more and more microscopic, and the bewilderment caused to some on finding "that the more detailed and specific is the study, the more insignificant are the results. . . . In other sciences the refinement of detail has led to the establishment of principles—but not so in geography." His answer to this is that the task of the geographer is, having learnt the details, finally to recognize the larger patterns on the Earth's surface. The smallest unit of study he would prefer to call the topographic; the intermediate, *i.e.* the regional divisions of the continents, the chorographic; and world distributions the geographic; but since "topographic" has other associations, he proposes to use the terms microchore, mesochore, and macrochore. Judging from a footnote, these hard terms are likely to enter American geographical literature.

The other papers submitted a systematic "check list" for the analysis of the human geography of a region, and "written structures for presenting the geography of regions," which appear singularly inconclusive. Both however agreed that studies should start with the present distributions and work back to the phenomena accounting for them. Though there was agreement that the boundaries to regions must be indefinite, and transition gradual, it was generally held that attempts to draw definite boundaries should be made. One consideration, which will strike most readers, was stated by a contributor to the discussion: that a good topographic map makes much of the proposed analysis unnecessary, since it already presents a synthesis.

OBITUARY

MARSHAL LYAUTEY

In the passing full of years and honour of Marshal Lyautey France mourns one of the most brilliant of her Colonial Administrators, whose name will surely be held in respectful memory by generations of his countrymen as the "maker" of Morocco, just as that of Cromer is held by us as the "maker" of Egypt. The Society was privileged to have an interest of its own in this great Frenchman, and now alas fulfils a sad duty in participating in the world-wide expression of regret at his passing, for the great Marshal's name has for years past figured on the distinguished roll of our Honorary Members. It is of interest to recall and restate now the circumstances of his election. It took place in 1921 on the occasion of the Centenary Celebration in July of that year of our sister Society, the French Société de Géographie. On that occasion the President (Sir Francis Younghusband), the Foreign Secretary, and the Secretary represented this Society, and at a Council Meeting of the Society on June 20 it was resolved that Prince Roland Buonaparte as President of the Société de Géographie and General Lyautey as a Frenchman of outstanding distinction be elected as Honorary Members of the Royal Geographical Society. On the same occasion the French Society awarded to General Lyautey, as he was then, the Special Gold Medal for his services to his country and indeed to geography in the course of his career as Administrator in Indo-China, Madagascar, and Morocco. Unfortunately General Lyautey was unable to be present himself at the Celebration owing to the disturbing conditions prevailing in Morocco at the time. It may be remembered that in November 1931 he honoured the Society by a personal visit to our House, and presented us with his portrait as a memento of the occasion. Later, in 1932, a volume entitled 'Intimate Letters from Tonquin,' in which the Marshal gave some account of his service in Indo-China was translated by Mrs. Aubrey Le Blond and reviewed in the Society's *Journal* for October 1932.

PROFESSOR G. F. SCOTT ELLIOT

We record with regret the death of Professor G. F. Scott Elliot on June 20 in his seventy-third year. In the late eighties and nineties of last century he travelled extensively in Africa as a botanist, although his interests were by no means limited to that study. After two years' work in South Africa, he crossed over to Madagascar to study its flora, describing his journeys in a short paper in the *Proceedings* (New Series, vol. 13, 1891). In subsequent years he visited Tripoli, Egypt, and Sierra Leone before turning his attention to the lesser known areas of Eastern Africa.

Having obtained a grant from the Royal Society, he set out in November 1893 from Mombasa for Ruwenzori. Despite difficulties with porters and the disturbed state of the country, he examined the eastern and western slopes of the massif, reaching 12,000 feet, and added very considerably to the information gathered by Stanley. He also made geological and botanical collections of importance. On his way to the coast he travelled south *via* the Kagera and Ruanda to Lake Tanganyika through areas previously unexplored. This journey, "the result of a most inconvenient love of botany," described in his 'Naturalist in Mid-Africa,' was his main contribution to geography, though he afterwards travelled in South America. He was for some time Professor of Botany at the Glasgow Veterinary College. Professor Scott Elliot was a kindly man, and of a very modest nature, so that few of his acquaintances were aware of his earlier activities. He joined the Society in 1895.